

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
ANANTAPUR ANANTHAPURAMU-515002 (A.P) INDIA**



**ACADEMIC REGULATIONS COURSE STRUCTURE  
AND  
DETAILED SYLLABI  
OF  
MASTER OF TECHNOLOGY  
IN  
PRODUCTION ENGINEERING AND ENGINEERIN DESIGN**

**Regular Two Year P.G. Degree Course  
(Applicable for the batches admitted from 2013-14)**



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**Academic Regulations For The Award Of Full Time M.Tech. P.G. Degree**  
**(WITH EFFECT FROM THE ACADEMIC YEAR 2013-14)**

The Jawaharlal Nehru Technological University Anantapur shall confer M.Tech. Post Graduate degree to candidates who are admitted to the Master of Technology Programs and fulfill all the requirements for the award of the degree.

**1.0 ELIGIBILITY FOR ADMISSIONS:**

Admission to the above programme shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each programme, from time to time.

**Admissions shall be made either on the basis of merit rank obtained by the qualified candidates at an Entrance Test conducted by the University or on the basis of GATE / PGECET score, subject to reservations prescribed by the University or Government policies from time to time.**

**2.0 COURSE WORK:**

- 2.1 A Candidate after securing admission must pursue the M.Tech. course of study for Four semesters duration.
- 2.2 Each semester shall be of 20 weeks duration including all examinations.
- 2.3 A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

**3.0 ATTENDANCE:**

- 3.1 A candidate shall be deemed to have eligibility to write end semester examinations if he has put in atleast 75% of attendance on cumulative basis of all subjects/courses in the semester.
- 3.2 Condonation of shortage of attendance up to 10% i.e., from 65% and above and less than 75% may be given by the college on the recommendation of the Principal.
- 3.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.
- 3.4 If the candidate does not satisfy the attendance requirement he is detained for want of attendance and shall reregister for that semester. He / she shall not be promoted to the next semester.

#### 4.0. EVALUATION:

The performance of the candidate in each semester shall be evaluated subject wise, with a maximum of 100 marks for Theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

- 4.1 For the theory subjects 60% of the marks will be for the External End Examination. While 40% of the marks will be for Internal Evaluation, based on the better of the marks secured in the two Mid Term-Examinations held, one in the middle of the Semester (I-IV units) and another immediately after the completion of instruction (V-VIII) units with Three questions to be answered out of four in 2hours, evaluated\* for 40 marks.

\*Note: All the Questions shall be of equal weightage of 10 marks and the marks obtained for 3questions shall be extrapolated to 40 marks, any fraction rounded off to the next higher mark

- 4.2 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day to day performance.
- 4.3 For Seminar there will be an internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts at the end of IV semester instruction.
- 4.4 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.
- 4.5 In case the candidate does not secure the minimum academic requirement in any of the subjects (as specified in 4.4.) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.

#### 5.0 RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS:

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

- 5.1 The candidate should have completed the course work and obtained examinations results for I & II semesters.
- 5.2 He should have passed all the subjects for which the Internal evaluation marks secured are more than 50%.
- 5.3 Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of three Theory subjects for Improvement of Internal evaluation marks.
- 5.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.
- 5.5 For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of the

Registrar, JNTUA payable at Anantapur along with the requisition through the Principal of the respective college.

- 5.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

## 6.0 EVALUATION OF PROJECT WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ institute.

- 6.1 Registration of Project work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Sem)
- 6.2 An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor and one internal senior expert shall monitor the progress of the project work.
- 6.3 The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest and one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.
- 6.4 The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.
- 6.5 A candidate shall be allowed to submit the thesis / dissertation only after passing in all the prescribed subjects (both theory and practical) and then take viva voce examination of the project. The viva-voce examination may be conducted once in two months for all the candidates submitted during that period.
- 6.6 Three copies of the Thesis / Dissertation certified in the prescribed form by the supervisor & HOD shall be presented to the HOD One copy is to be forwarded to the University and one copy to be sent to the examiner.
- 6.7 The college shall submit a panel of three experts for a maximum of 5 students at a time. However, the thesis / dissertation will be adjudicated by one examiner nominated by the University.
- 6.8 If the report of the examiner is favorable viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis / dissertation. The board shall jointly report candidates work as:
- |    |                  |         |
|----|------------------|---------|
| 1. | Very Good        | Grade A |
| 2. | Good             | Grade B |
| 3. | Satisfactory     | Grade C |
| 4. | Not satisfactory | Grade D |

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the thesis.

**7.0 AWARD OF DEGREE AND CLASS:**

A candidate shall be eligible for the award of respective degree if he satisfies the minimum academic requirements in every subject and secures 'satisfactory' or higher grade report on his thesis/dissertation and viva-voce. Based on overall percentage of marks obtained, the following class is awarded.

First class with Distinction:	70% or more
First class	below 70% but not less than 60%
Second class	below 60% but not less than 50%

**8.0 WITH – HOLDING OF RESULTS:**

If the candidate has not paid dues to the university or if any case of in-discipline is pending against him, the result of the candidate shall be withheld and he will not be allowed/ promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

**9.0 TRANSITORY REGULATIONS:**

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to 4.5 and 2.3 sections. Whereas they continue to be in the academic regulations they were first admitted.

**10.0 GENERAL:**

- i. The academic regulations should be read as a whole for purpose of any interpretation.
- ii. Disciplinary action for Malpractice / improper conduct in examinations is appended.
- iii. There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.
- iv. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
- v. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- vi. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

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**APPROVED REVISION OF RULES FOR DISCIPLINARY ACTION FOR  
MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS**

	<b>Nature of Malpractices/Improper conduct</b>	<b>Punishment</b>
	<i>If the candidate:</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	<b>The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared</b>

		<p>and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations, if his involvement is established. Otherwise, The candidate is debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</p> <p><b>If the imposter is an outsider, he will be handed over to the police and a case is registered against him.</b></p>
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or	<b>In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against</b>

	indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	<b>them.</b>
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the



		remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	<b>Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations, depending on the recommendation of the committee.</b>
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

#### **Malpractices identified by squad or special invigilators**

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
  - (i) A show cause notice shall be issued to the college.
  - (ii) Impose a suitable fine on the college.
  - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

**Note: Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfill all the norms required for the award of Degree.**

2013-14

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**Course Structure and syllabi for**

**M.Tech- Production Engineering and Engineering Design**

**Offered by Department of Mechanical Engineering**

**for affiliated Engineering Colleges 2013-14**

**I YEAR I Semester**

S. No	Course code	Subject	Theory	Lab.	Credits
1.	9D04102	Finite Element Methods	4		4
2.	9DBS101	Computational methods	4		4
3.	9D04105	Advances in Manufacturing Technology	4		4
4.	9D15203	Mechanical Vibrations	4		4
5.	9D04201	Advanced Optimization Techniques	4		4
		Elective-I	4		4
	9D04108	a. Design for Manufacturing			
	9D04206	b. Rapid Prototyping			
	12D87207	c. Design and manufacturing of MEMS and MICRO systems			
6.	13D90101	Design Simulation Laboratory		3	2
Total Credits					26

**I YEAR II Semester**

S. No	Course code	Subject	Theory	Lab.	Credits
1.	12D87208	Industrial Robotics	4		4
2.	12D87101	Automation in Manufacturing	4		4
3.	12D87203	Simulation & Modeling of Manufacturing systems	4		4
4.	9D15102	Advanced Mechanisms	4		4
	9D04208	Mechanics & Manufacturing Methods of Composites			
5.	9D04203 13D90201 9D15108	Elective-II a. Computer Graphics b. Material Technology c. Non-destructive Evaluation	4		4
6.	12D87209	Manufacturing Simulation Laboratory	4		4
	Total Credits				26

**II YEAR (III & IV Semesters)**

S. No	Course code	Subject		credits
1	13D90401	Seminar		2
2	13D90402	Project work		16

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech- I Sem (PEED)

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4	4

## (9D04102) FINITE ELEMENT METHODS

**UNIT - I**

**Formulation Techniques:** Methodology, Engineering problems and governing differential equations, finite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

**UNIT – II**

**One-dimensional finite element methods:** Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin,

**UNIT – III**

**Trusses:** Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects.

**UNIT – IV**

**Beams and Frames:** Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

**UNIT - V**

**Two dimensional problems:** CST, LST, four noded and eight noded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

**UNIT – VI**

**Isoparametric formulation:** Concepts, sub parametric, super parametric elements, numerical integration.

**UNIT – VII**

**Finite elements in Structural Dynamics:** Dynamic equations, eigen value problems, and their solution methods, simple problems.

**UNIT – VIII**

**Convergence:** Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, pascal's triangle.

**Text Book:**1) Finite element methods by Chandraputla & Belagondu.

**References:**

1. J.N. Reddy, Finite element method in Heat transfer and fluid dynamics, CRC press,1994
2. Zienkiwicz O.C. & R. L. Taylor, Finite Element Method, McGraw-Hill,1983.
3. J. N. Oden, Finite Element of Nonlinear continua, McGraw-Hill, New York, 1971
4. K. J. Bathe, Finite element procedures, Prentice-Hall, 1996

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech- I Sem (PEED)

Th	C
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## (9DBS101) COMPUTATIONAL METHODS

**Unit – I**

**Introduction to numerical methods applied to engineering problems:** Examples, solving sets of equations – Matrix notation – Determinants and inversion – Iterative methods – Relaxation methods – System of non-linear equations – computer programs

**Unit – II**

**Numerical integration:** Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration

**Unit – III**

**Optimization:** One dimensional unconstrained optimization, multidimensional unconstrained optimization –direct methods and gradient search methods, constrained optimization

**Unit – IV: Boundry value problems and charecteristic value problems:** Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.

**Unit – V**

**Numerical solutions of partial differential equations:** Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

**Unit – VI**

**Parabolic partial differential equations:** Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs.

**Unit – VII**

**Hyperbolic partial differential equations:** Solving wave equation by finite differences-stability of numerical method –method of characteristics-wave equation in two space dimensions-computer programs.

**Unit – VIII**

**Curve fitting and approximation of functions:** Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression - computer programs.

**TEXT BOOKS:**

1. Steven C.Chapra, Raymond P.Canale “Numerical Methods for Engineers” Tata Mc-Graw hill
- 2.Curtis F.Gerald, partick.O.Wheatly,”Applied numerical analysis”Addison-wesley,1989
- 3.Douglas J..Faires,Riched Burden”Numerical methods”Brooks/cole publishing company,1998.Second edition.

**References:**

- 1.Ward cheney &David Kincaid “Numerical mathematics and computing”Brooks/cole publishing company1999,fourth edition.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****M.Tech- I Sem (PEED)****Th C**  
**4 4****(9D04105) ADVANCES IN MANUFACTURING TECHNOLOGY**

**Unit – I Welding Processes:** Fusion and Solid state welding process, Automation in Welding, Design aspects of welds, Weldability of aluminium alloys, titanium alloys and High strength low alloy steels, Non destructive testing of welds, Residual stresses and distortion in weldments.

**Unit – II Surface Processing Operations:** Plating and Related Processes, Conversion Coatings, Physical Vapor Deposition, Chemical Vapor Deposition, Organic Coatings, Porcelain Enameling and other Ceramic coatings, Thermal and Mechanical Coating Processes.

**Unit – III Un-conventional Machining Methods-I:**

Abrasive jet machining - Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments.

Ultrasonic machining: Elements of the process, machining parameters, effect of parameters on surface finish and metal removal rate, mechanics of metal removal process parameters, economic considerations, applications and limitations.

**Unit – IV Un-conventional Machining Methods-II:**

Electro-Chemical Processes: Fundamentals of electro chemical machining, metal removal rate in ECM, Tool design, Surface finish and accuracy economics aspects of ECM.

Wire EDM Process: General Principle and applications of Wire EDM, Mechanics of metal removal, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy.

**Unit – V Un-conventional Machining Methods-III:**

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages, limitations, comparison of thermal and non-thermal processes.

**Unit – VI Plasma Arc Machining:** Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations

Laser Beam Machining: Principle, effect of machining parameters on surface finish, applications, and limitations.



**Unit – VII Rapid Prototyping:** Working principle, methods-Steriolithography, Laser sintering, Fused deposition method, applications and limitations.

**Unit – VIII Nano Technology:** Nano milling processes, wet milling, dry milling, nano materials, fabrication of nano tubes, advantages of nano tubes, mechanical properties.

**Text Books:**

1. Manufacturing Technology - P. N. Rao, TMH Publishers
2. Fundamentals of Modern Manufacturing, Mikell P. Groover, John Wiley & Sons Publishers

**References:**

1. Production Technology - HMT
2. Manufacturing Science - Cambel
3. Welding Technology - R.S, Parmar,
4. Introduction to Nanotechnology - Poole and Owens, Wiley (2003).

M.Tech- I Sem (PEED)

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**(9D15203) MECHANICAL VIBRATIONS****Unit I**

Single degree of Freedom systems I: Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation ;Vibration isolation and transmissibility

**Unit II**

Single degree of Freedom systems II: Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

**Unit III**

Vibration measuring instruments : Vibrometers, velocity meters & accelerometers

**Unit IV**

Two degree freedom systems: Principal modes – undamped and damped free and forced vibrations ; undamped vibration absorbers ;

**Unit V**

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

**Unit VI**

Numerical Methods: Rayleigh's, Stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

**Unit VII**

Continuous systems: Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams Torsional vibrations of shafts.

**Unit VIII**

Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Text books:

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K. Groover.

References:

1. Vibrations by W.T. Thomson
2. Mechanical Vibrations – Schaum series.
3. Vibration problems in Engineering by S.P. Timoshenko.
4. Mechanical Vibrations – V.Ram Murthy.

AMTUA

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech- I Sem (PEED)

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## (9D04201) ADVANCED OPTIMIZATION TECHNIQUES

**UNIT - I**

**Linear programming:** Two-phase simplex method, Big-M method, duality, interpretation, applications.

**UNIT - II**

**Assignment problem:** Hungarian's algorithm, Degeneracy, applications, unbalanced problems, traveling salesman problem.

**UNIT - III**

**Classical optimization techniques:** Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

**UNIT - IV**

**Numerical methods for optimization:** Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

**UNIT - V**

**Genetic algorithm (GA) :** Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

**UNIT - VI**

**Genetic Programming (GP):** Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

**UNIT – VII**

**Multi-Objective GA:** Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems .

**UNIT VIII**

**Applications of Optimization in Design and Manufacturing systems:** Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of

weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

**Text Books:**

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers

**References:**

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****M.Tech- I Sem (PEED)****Th C**  
**4 4****(9D04108) DESIGN FOR MANUFACTURING**  
**(Elective-I)****UNIT - I**

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

**UNIT - II**

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

**UNIT - III**

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

**UNIT - IV**

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

**UNIT - V**

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

**UNIT – VI**

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

**UNIT – VII**

**Extrusion & Sheet metal work:** Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

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## UNIT VII

**Plastics:** Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

### Text Books:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,

### References:

1. ASM Hand book Vol.20

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## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech- I Sem (PEED)

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**(9D04206) RAPID PROTOTYPING****(Elective-I)****Unit-I**

**Introduction:** Need for the compression in product development, History of RP system, Survey of applications, Growth of RP industry and classification of RP system.

**Unit –II**

**Stereo Lithography System:** Principle, Process parameter, Process details, Data preparation, Data files and machine details, Applications.

**Unit III**

**Fusion Decomposition Modeling:** Principle, process parameter, Path generation, Applications.

**Unit IV**

**Solid ground curing:** Principle of operation, Machine details, Applications,  
**Laminated Object Manufacturing:** Principle of Operation, LOM materials, Process details, Applications.

**Unit –V**

**Concepts Modelers:** Principle, Thermal jet printer, Sander's model market, 3-D printer, Genisys Xs printer HP system 5, Object Quadra system.

**Unit –VI****LASER ENGINEERING NET SHAPING (LENS)**

**Rapid Tooling:** Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling Spray metal tooling, Cast krikSITE, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

**Software for RP:** STL files, Overview of Solid view, magics, imics, magic communication, etc. Internet based software, Collaboration tools.

**Unit VII**



**Rapid Manufacturing Process Optimization:** Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

### Unit VIII

**Allied Process:** Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification- Data transfer to solid models.

#### TEXT BOOKS:

1. Paul F.Jacobs – “ **stereo lithography and other RP & M Technologies**”, SME, NY 1996
2. Flham D.T & Dinjoy S.S – “ **Rapid Manufacturing** “ Verlog London 2001
3. Lament wood, “**Rapid automated** “ , Indus Press New York.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****M.Tech- I Sem (PEED)****Th C**  
**4 4****(12D87207) DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS**  
**(Elective-I)****UNIT - I:**

**Overview and working principles of MEMS and Microsystems:** MEMS and Microsystems, Evolution of Micro fabrication, Microsystems and Microelectronics, Microsystems and miniaturization, Applications of MEMs in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

**UNIT - II:**

**Engineering Science for Microsystems Design and Fabrication:** Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

**UNIT - III:**

**Engineering Mechanics for Microsystems Design:** Static Bending of Thin plates, Mechanical Vibration, Thermo mechanics , Fracture Mechanics, Thin- Film Mechanics, Overview of Finite Element Stress Analysis

**UNIT - IV:**

**Thermo Fluid Engineering and Microsystems Design:** Overview of Basics of Fluid Mechanics in Macro and Mesoscales, Basic equations in Continuum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid flow in Sub micrometer and Nano scale,

**UNIT V**

Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design

**UNIT VI**

Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

**UNIT VII & VIII**

**Materials for MEMS and Microsystems and their fabrication:** Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers,

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Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

**TEXT BOOK:**

1. MEMS and Microsystems. Design and Manufacturing, Tia-Ran Hsu, TMH 2002
2. Foundation of MEMS, Chang Liu, Pearson, 2012

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M.Tech- I Sem (PEED)**

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**(13D90101) DESIGN SIMULATION LABORATORY**

**I. Modeling**

- 1.Surface modeling
- 2.Solid modeling
- 3.Drafting
- 4.Assembling

**II. Structural Analysis using any FEA Package** for different structures that can be discretised with 1-D,2-D & 3-D elements

1. Static Analysis
2. Modal Analysis
3. Harmonic Analysis
4. Spectrum Analysis
5. Buckling Analysis
6. Analysis of Composites
7. Fracture mechanics

**References :**

User manuals of ANSYS package Version 10.0  
PRO/E, I-DEAS Package /UNIGRAPHICS,CATIA

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**M.Tech- II Sem (PEED)**

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**(12D87208) INDUSTRIAL ROBOTICS**

**UNIT - I:** Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.

**UNIT-II: CONTROL SYSTEM AND COMPONENTS:** basic concept and modals controllers control system analysis, robot actuators and feedback components (sensors): Internal and External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics , Power Transmission Systems.

**UNIT - III: MOTION ANALYSIS AND CONTROL:** Manipulator kinematics, position representation Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward and Inverse transformations, problems on planar and spatial manipulators,

**UNIT-IV:** Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated and Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending.

**UNIT - V: ROBOT DYNAMICS:** Lagrange – Euler and Newton Euler formulations, problems on two link planar manipulators, configuration of robot controller.

**UNIT-VI: END EFFECTORS:** Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.

**MACHINE VISION:** Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

**UNIT - VII: ROBOT PROGRAMMING:** Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SIGNAL AND DELAY commands, Branching capabilities and Limitations.

**ROBOT LANGUAGES:** Textual robot languages, Generation, Robot language structures, Elements and functions.

**UNIT - VIII: ROBOT CELL DESIGN AND CONTROL:** Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.

ROBOT APPLICATIONS: Material transfer, Machine loading/unloading. Processing operations, Assembly and Inspection, Future Applications.

**TEXT BOOKS:**

1. Introduction to Robotics Mechanics and *Control*, John J.Craig, Pearson
2. Industrial robotics , Mikell P.Groover , McGraw Hill.
3. Modelling and *Control* of Robot Manipulators, L.Sciavicco & B.Siciliano, Springer

**REFERENCE BOOKS:**

1. Robotics , K.S.Fu , McGraw Hill.
2. Robot Analysis, Lung Wen Tsai, John Wiley & Sons
3. Robotics and control ,RK Mittal & IJ Nagrath, Tata McGrawHill
4. Fundamentals of Robotics,Robert J.schilling,PHI
5. Robotics ,Saha, TMG
6. Robotic Engineering, Richard D.Klafter, Thomas A.Chmielewski,PHI

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**M.Tech- II Sem (PEED)**

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**(12D87101) AUTOMATION IN MANUFACTURING****UNIT-I:**

**Introduction to Automation:** Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies.

**UNIT-II**

Manufacturing operations, Production Concepts and Mathematical Models, Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

**UNIT-III:**

Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems.

**UNIT-IV**

Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

**UNIT -V:**

Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines,

**UNIT-VI**

Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

**UNIT-VII:**

Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

**UNIT-VIII:**

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts

Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines , Partial Automation.

**TEXT BOOKS:**

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover, Pearson Education.

**REFERENCE BOOKS:**

1. CAD CAM : Principles, Practice and Manufacturing Management, Chris Mc Mohan, Jimmie Browne , Pearson edu. (LPE)

2. Automation, Buckingham W, Haper & Row Publishers, New York, 1961

3. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M.Tech- II Sem (PEED)**

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**(12D87203) SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS**

**UNIT - I:**

System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages and Disadvantages.

**UNIT-II**

Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1 & 2 errors – Framing – Strang law of large numbers.

**UNIT - III:**

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model.

**UNIT-IV**

Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

**UNIT - V:**

Generation of random variants – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – Weibull – normal Bernoullie – Binomial – uniform – Poisson.

**UNIT-VI**

Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages. QUEST, WITNESS, PROMODEL and AUTOMOD

**UNIT - VII :**

Output data analysis – Types of Simulation with respect to output data analysis – warm up period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

**UNIT – VIII :**

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

**TEXT BOOKS:**

1. Simulation Modelling and Analysis, Law, A.M.& Kelton , McGraw Hill, 2nd Edition, New York, 1991.
2. Discrete Event System Simulation, Banks J. & Carson J.S., PH , Englewood Cliffs, NJ, 1984.
3. Simulation of Manufacturing Systems, Carrie A. , Wiley, NY, 1990.
4. A Course in Simulation, Ross, S.M., McMillan, NY, 1990.
5. Simulation Modelling and SIMNET , Taha H.A. , PH, Englewood Cliffs, NJ, 1987
- 6, Performance modeling and analysis of manufacturing systems, Viswanatham & Narahari, PHI

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**M.Tech- II Sem (PEED)**

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**(9D15102) ADVANCED MECHANISMS**

**Unit – I: Introduction:** Elements of Mechanisms; Mobility Criterion for Planar mechanisms and manipulators; Mobility Criterion for spatial mechanisms and manipulators. Spherical mechanisms-spherical trigonometry.

**Unit – II: Advanced Kinematics of plane motion- I:** The Inflection circle ; Euler – Savary Equation; Analytical and graphical determination of di ; Bobillier’s Construction ;Collineation axis ; Hartmann’s Construction ;Inflection circle for the relative motion of two moving planes; Application of the Inflection circle to kinematic analysis.

**Unit – III: Advanced Kinematics of plane motion - II:** Polode curvature; Hall’s Equation; Polode curvature in the four bar mechanism; coupler motion; relative motion of the output and input links; Determination of the output angular acceleration and its Rate of change; Freudenstein’s collineation –axis theorem; Carter –Hall circle; The circling – point curve for the Coupler of of a four bar mechanism.

**Unit – IV: Introduction to Synthesis-Graphical Methods - I:** The Four bar linkage ;Guiding a body through Two distinct positions; Guiding a body through Three distinct positions; The Rotocenter triangle ; Guiding a body through Four distinct positions; Burmester’s curve.

**Unit – V: Introduction to Synthesis-Graphical Methods - II:** Function generation-General discussion; Function generation: Relative –rotocenter method, Overlay’s method, Function generation- Velocity – pole method; Path generation: Hrones’s and Nelson’s motion Atlas, Roberts’s theorem.

**Unit – VI: Introduction to Synthesis - Analytical Methods:** Function Generation: Freudenstien’s equation, Precision point approximation, Precision – derivative approximation; Path Generation: Synthesis of Four-bar Mechanisms for specified instantaneous condition; Method of components; Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link; Method of components.

**Unit – VII: Manipulator kinematics – I:** D-H notation, D-H convention of assignment of co-ordinate frames and link parameters table;D-H transformation matrix ; Direct and Inverse kinematic analysis of Serial manipulators: Articulated ,spherical & industrial robot manipulators- PUMA, SCARA,STANFORD ARM, MICROBOT.

**Unit – VIII: Manipulator kinematics – II:** Differential kinematics Formulation of Jacobian for planar serial manipulators and spherical manipulator; Singularity analysis.

**Text Books:**

1. Jeremy Hirschhorn, Kinematics and Dynamics of plane mechanisms, McGraw-Hill,1962.
2. L.Sciavicco and B.Siciliano, Modelling and control of Robot manipulators, Second edition , Springer -Verlag,London,2000.
3. Amitabh Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines. E.W.P.Publishers.

**Reference Books:**

1. Allen S.Hall Jr., Kinematics and Linkage Design, PHI,1964.
2. J.E Shigley and J.J . Uicker Jr., Theory of Machines and Mechanisms , McGraw-Hill, 1995.
3. Mohsen Shahinpoor, A Robot Engineering Text book,Harper & Row Publishers, New York,1987.
4. Joseph Duffy, Analysis of mechanisms and Robot manipulators, Edward Arnold,1980

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**M.Tech- II Sem (PEED)**

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**(9D04208) MECHANICS AND MANUFACTURING METHODS OF COMPOSITES**

**Unit – I**

**Basic concepts and characteristics:** Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites,

**Unit – II**

**Reinforcements:** Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

**Unit – III**

**Micromechanics:** Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

**Unit – IV**

**Coordinate transformations:** Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

**Unit – V**

**Elastic behavior of unidirectional composites:** Elastic constants of lamina, relation ship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

**Unit – VI**

**Strength of unidirectional lamina:** Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants.

**Unit – VII**

**Analysis of laminated composite plates**

Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

**Unit – VIII**

**Manufacturing methods:** Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

**Text Books:**

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials by Isaac and M. Daniel, Oxford University Press, 1994.

**References:**

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M.Tech- II Sem (PEED)**

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**(9D04203) COMPUTER GRAPHICS**

**(Elective-II)**

**Unit - I**

**Introduction to computer graphics:** Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, hard copy devices.

**Unit - II**

**Raster scan graphics:** Line drawing algorithms – DDA & Bresenham algorithms, circle generation, general function rasterization, displaying lines, characters and polygons.

**Unit - III**

**Filling algorithms:** polygon filling, edge fill algorithm, seed fill algorithm, fundamentals of antialiasing and half toning.

**Unit - IV**

**Line CLIPPING:** Simple visibility algorithm, Cohen-Sutherland subdivision line clipping algorithm, mid point sub division algorithm.

**Unit - V**

**Polygon clipping:** polygon clipping, reentrant polygon clipping – Sutherland – Hodgeman algorithm, character clipping, 3D- clipping.

**Unit - VI**

**Transformations:** Cartesian and homogeneous coordinate systems two dimensional and three dimensional transformations – scaling, rotation, Shearing, Zooming, viewing transformation, reflection, rotation about an axis, concatenation.

**Unit - VII**

**Rendering:** Hidden line removal algorithms, surface removal algorithms, painters, Warnock, Z-buffer algorithm.

**Unit - VIII**

**Shading algorithms:** Constant intensity algorithm, Phong's shading algorithm, gourand shading algorithm, Comparison of shading algorithms.

**Text Books:**

- 1.Procedural elements for computer graphics-D.F.Rogers, Tata McGraw-Hill.
- 2.Computer Graphics-Donald Hearn & M.P. Bakers.
- 3.Computer graphics-Harrington.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****M.Tech- II Sem (PEED)****Th C**  
**4 4****(13D90201) MATERIAL TECHNOLOGY**  
**(Elective-II)****UNIT – I:**

Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening

**UNIT-II**

Poly phase mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material.

**UNIT – III:**

Griffith's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson – Miller Parameter, Deformation and Fracture mechanism maps.

**UNIT – IV:**

Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

**UNIT – V:**

Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, Auto, Marine, Machinery and Nuclear Applications.

Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep

**UNIT – VI:**

**Modern Metallic Materials:** Dual Phase Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Intermetallics, Ni and Ti Aluminides

**UNIT-VII**

Smart Materials, Shape Memory alloys, Metallic Glass, Quasi Crystal and Nano Crystalline Materials. Metal-Matrix composites



**UNIT-VIII**

**Nonmetallic Materials:** Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, Structure, Properties and Applications of engineering Polymers

**TEXT BOOKS:**

1. Mechanical Behaviour of Materials, Thomas H. Courtney, 2nd Edition, McGraw Hill,2000.
2. Mechanical Metallurgy, George E. Dieter, McGraw Hill,1998.

**REFERENCE BOOK:**

1. Selection and use of Engineering Materials,Charles J.A, Butterworth Heiremann

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****M.Tech- II Sem (PEED)****Th C**  
**4 4****(9D15108) NON - DESTRUCTIVE EVALUATION**  
**(Elective-II)****Unit – I**

**Ultra Sonic Hardness Testing:** Flaw Detection Using Dye Penetrants. Magnetic Particle Inspection introduction to electrical impedance, Principles of Eddy Current testing, Flaw detection using eddy currents.

**Unit – II**

**Introduction to X-Ray Radiography:** The Radiographic process, X-Ray and Gamma-ray sources, Geometric Principles, Factors Governing Exposure, Radiographic screens, Scattered radiation, Arithmetic of exposure, Radiographic image quality and detail visibility, Industrial X-Ray films,

**Unit – III**

**X-Ray Radiography processes:** Fundamentals of processing techniques, Process control, The processing Room, Special Processing techniques, Paper Radiography, Sensitometric characteristics of x-ray films, Film graininess signal to noise ratio in radiographs, The photographic latent image, Radiation Protection,

**Unit – IV**

**Introduction to Ultrasonic Testing:** Generation of ultrasonic waves, Horizontal and shear waves, Near field and far field acoustic wave description, Ultrasonic probes- straight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media,

**Unit – V**

**Ultrasonic tests:** Transmission and pulse echo methods, A-scan, B-scan, C-scan, F-scan and P-scan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, Zonal method using focused beam. Flow location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echos and noise. Ultrasonic flaw evaluation.

**Unit – VI**

**Holography:** Principles and practices of Optical holography, acoustical, microwave, x-ray and electron beam holography techniques.

**Unit – VII**

**Applications - I:** NDT in flaw analysis of Pressure vessels, piping

**Unit – VIII**

**Applications - II:** NDT in Castings, Welded constructions, etc., Case studies.

**Text books:**

1. Ultrasonic testing by Krautkramer and Krautkramer
2. Ultrasonic inspection 2 Training for NDT : E. A. Gengel, Prometheus Press,
3. ASTM Standards, Vol 3.01, Metals and alloys

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**M.Tech- II Sem (PEED)**

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**(12D87209) MANUFACTURING SIMULATION LAB**

- 1.Study of elements , entities , activities and basic models of a simulation package modeling and simulation
- 2.Throughput analysis of a individual production facility using simulation.
3. Modeling of a typical manufacturing facility and study its performances.
4. Breakdown analysis of a production facility with one machine
5. Breakdown analysis of a production system having multiple machines
- 6.Modeling and Simulation of layouts
- 7.Study of transport system in a shop floor
- 8.Buffer size design
- 9.Identification of bottleneck machine on a given shop floor
- 10.Study of conjunction, collision and dead locks through simulation

**Lab Facilities**

Adequate number of Computer Systems in Networked Environment

Packages : 1. QUEST

2.PROMODEL

3.FLEXSIM

4.AUTOMOD

5.WITNESS