ACADEMIC REGULATIONS

PROGRAM STRUCTURE

and

DETAILED SYLLABUS

Master of Technology

(Design for Manufacturing)

(Two Year Regular Programme)

(Applicable for Batches admitted from 2018)

Gokaraju Rangaraju Institute of Engineering and Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

Academic Regulations

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
For all Post Graduate Programmes (M.Tech)
GR18 REGULATIONS

Gokaraju Rangaraju Institute of Engineering & Technology - 2018 Regulations (GR 18 Regulations) are given hereunder. These regulations govern all the Post Graduate programmes offered by various departments of Engineering with effect from the students admitted to the programmes in 2018-19 academic year.

1. **Programme Offered:** The Post Graduate programme offered by the department is M.Tech, a two-year regular programme in that discipline.
2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.
3. **Admissions:** Admission into the M.Tech Programme in any discipline shall be made subject to the eligibility and qualifications prescribed by the University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in PGCET conducted by the APSCHE for M. Tech Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.
4. **Programme Pattern:**
    - **a) A student is introduced to "Choice Based Credit System (CBCS)" for which he/she has to register for the courses at the beginning of each semester as per the procedure.**
    - b) Each Academic year of study is divided into two semesters.
    - c) Minimum number of instruction days in each semester is 90.
    - d) The total credits for the Programme is 68.
    - **e) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).**
    - **f) A student has a choice of registering for credits from the courses offered in the programme.**
    - **g) All the registered credits will be considered for the calculation of final CGPA.**
5. **Award of M.Tech Degree:** A student will be declared eligible for the award of the M. Tech Degree if he/she fulfills the following academic requirements:
    - a) A student shall be declared eligible for the award of M.Tech degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.
    - b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech course.
    - c) The Degree of M.Tech shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements

a) A student shall be eligible to appear for the semester end examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.

d) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re- registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment

a) Paper setting and Evaluation of the Answer Scripts shall be done as per the procedures laid down by the Academic Council of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

Particulars	Internal Evaluation	External Evaluation	Total
Theory	30	70	100
Practical	30	70	100
Mini Project	30	70	100
Dissertation	30	70	100

c) The marks for internal evaluation per semester per theory course are divided as follows:

i.	**Mid Examinations:**	**20 Marks**
ii.	**Tutorials/Assignment:**	**5 Marks**
iii.	**Continuous Assessment:**	**5 Marks**
	Total:	**30 Marks**

d) **Mid Examination:** There shall be two mid examinations during a semester. The first mid examination shall be conducted from the first 50 per cent of the syllabus and the second mid examination shall be conducted from the remaining 50 per cent of the syllabus. The mid examinations shall be evaluated for **20 marks** and average of the marks scored in the two mid examinations shall be taken as the marks scored by each student in the mid examination for that semester.

e) **Assignment:** Assignments are to be given to the students and marks not exceeding 5 (5%) per semester per paper are to be awarded by the teacher concerned.

f). **For Internal Evaluation in Practical/Lab Subjects:** The marks for internal evaluation are 30. Internal Evaluation is done by the teacher concerned with the help of the other staff members nominated by Head of the Department. Marks Distribution is as follows:

i.	Internal Exam:	10 Marks
ii.	Record:	05 Marks
iii.	Continuous Assessment:	15 Marks
	Total:	30 Marks

g). For External Evaluation in Practical/Lab Subjects: The semester end examination shall be conducted by an external examiner and a staff member of the department nominated by Head of the Department.

h). For approval and evaluating mini project, Dissertation-I and Dissertation-II, a project Review Committee (PRC) will be constituted by the Head of the Department. The composition of PRC is as follows i) Head of the Department ii) one senior faculty relevant to the specialization iii) coordinator of the specialization.

i. **Mini Project:** The Mini Project is to be taken up with relevance to Industry and is evaluated for 100 marks. Out of 100 marks, 30 marks are for internal evaluation and 70 marks are for external evaluation.

Internal Evaluation: For internal evaluation, 10 Marks are given by PRC based on project reviews and 5 marks for the quality of report and abstract submitted. The supervisor continuously assesses the student performance for 15 marks. Tentative presentation dates and marks distribution of the mini project

S.No	Date	Review	Marks
Internal Marks (30)			
1	First week of the semester	Abstract submission*	5
2	Mid of the semester	Second review	10
3	Last week of the semester	Last review	15

*Following are the guidelines for the abstract submission

The faculty are requested to check the document submitted in the first review and should contain following

1. Title of the project and Literature review
2. Schematic/Block diagram which gives the board idea of the entire project (Mini project to major project in 3rd and 4th semesters)
3. Timeline or milestone of the project. It should clearly indicate deliverables/outcomes of the project.
4. Components required with approximate cost
5. References

External Evolution: (70 Marks)

The mini project report is presented before PRC along with the supervisor and the same is evaluated for 70 marks. At the end of the semester the mini project report is evaluated by PRC.

Guidelines to award 70 marks:

S.No	Date	Review/ PRC report	Marks
External Evaluation Marks (70)			
1	Last week of the semester	Final Presentation and report Submission	10
2	Project report :Project report should be written as per IEEE guidelines.	Verified by PRC	20
3	Project Deliverables • Hardware prototype • Simulation in any authorized software • Submission of research articles in any Scopus indexed conference /Journal	Verified by PRC	30
4	Results and Discussion	Verified by PRC	10

ii. Dissertation (Phase I & Phase II):

Internships/Seminars/Dissertation Phase I:

The Dissertation Phase I, the department help the students to do the projects supported by the industry and is evaluated for 100 marks. Out of 100 marks, 30 marks are for internal evaluation and 70 marks are for external evaluation.

Internal Evaluation: For internal evaluation, 10 Marks are given by the PRC based on project reviews and 5 marks for the quality of report and abstract submitted. The supervisor continuously assesses the student performance for 15 marks. Tentative presentation dates and marks distribution of the mini project

S.No	Date	Review	Marks
Internal Marks (30)			
1	lst week of the semester	Abstract submission*	5
2	Mid of the semester	Second review	10
3	Last week of the semester	Last review	15

*Following are the guidelines for the abstract submission

The faculty are requested to check the document submitted in the first review and should contain following

1. Title of the project and the literature review
2. Schematic/Block diagram which gives the board idea of the entire project
3. Timeline or milestone of the project. It should clearly indicate deliverables/outcomes of the project.
4. Components required with approximate cost
5. Possibility to develop Product

External Evaluation: (70 Marks)

The mini project report is presented before PRC along with the supervisor and the same is evaluated for 70 marks. At the end of the semester the mini project report is evaluated by PRC.

Guidelines to award 70 marks:

S.No	Date	Review/ PRC report	Marks
External Evaluation Marks (70)			
1	Last week of the semester	Final Presentation and report Submission	10
2	Project report submission- Project report should be written as per IEEE guidelines.	Verified by PRC	20
3	Project Deliverables • Hardware prototype • Simulations in any authorized software • Submission of research articles in any Scopus indexed conference /Journal • Product development • Industry Support	Verified by PRC	30
4	Results and Discussion	Verified by PRC	10

iii. Dissertation Phase II:

Dissertation Phase II:

The Dissertation Phase II, the department help the students to do the project at industry and is evaluated for 100 marks. Out of 100 marks, 30 marks are for internal evaluation and 70 marks are for external evaluation. It is expected that along with the project he will be placed in the company.

Internal Evaluation: For internal evaluation, 10 Marks are given by the PRC based on project reviews and 5 marks for the quality of report and abstract submitted. The supervisor continuously assesses the student performance for 15 marks. Tentative presentation dates and marks distribution of the mini project

S.No	Date	Review	Marks
Internal Marks (30)			
1	Ist week of the semester	Abstract submission*	5
2	Mid of the semester	Second review	10
3	Last week of the semester	Last review	15

*Following are the guidelines for the abstract submission

The faculty are requested to check the document submitted in the first review and should contain following

1. Title of the project and the literature review
2. Schematic/Block diagram which gives the board idea of the entire project
3. Timeline or milestone of the project. It should clearly indicate deliverables/outcomes of the project.
4. Components required with approximate cost
5. Possibility to develop Product and IPR

External Evaluation: (70 Marks)

The mini project report is presented before PRC along with the supervisor and the same is evaluated for 70 marks. At the end of the semester the mini project report is evaluated by PRC.

Guidelines to award 70 marks:

S.No	Date	Review/ PRC report	Marks
External Evaluation Marks (70)			
1	Last week of the semester	Final Presentation and report Submission	10
2	Project report submission- Project report should be written as per IEEE guidelines.	Verified by PRC and External Examiner	20
3	Project Deliverables • Hardware prototype • Simulations in any authorized software • Submission of research articles in any Scopus indexed conference /Journal • Product development • Industry Support	Verified by PRC and External Examiner	30
4	Results and Discussion	Verified by PRC and External Examiner	10

Rules and regulations related to Internships/Seminars/Dissertation Phase I and II:

The student must work under the guidance of both internal guide (one faculty member of the department) and external guide (from Industry not below the rank of an officer). Internal guide is allotted by the Head of the Department or Program Coordinator, whereas external guide is allotted by the industrial organization in which the project is undertaken.

- After approval from the PRC, the final thesis is to be submitted along with ANTI-PLAGIARISM report from the approved agency with a similarity index not more than 24%.
- Two hardcopies and one soft copy of the project work (dissertation) certified by the research supervisors shall be submitted to the College/Institute.
- The thesis shall be adjudicated by one external examiner selected by the Institute out of 5-member panel, submitted by the department.

- In both internal and external evaluations, the student shall score at least 40% marks and an aggregate of 50% marks to pass in the project work. If the project report is satisfactory, Viva-voce examination shall be conducted by a Board consisting of the Supervisor, Head and the External Examiner who adjudicated the project work. The Board shall jointly evaluate the student's performance in the project work.
- In case the student doesn't pass through the project work, he/she must reappear for the viva-voce examination, as per the recommendations of the Board. If he fails succeed at the second Viva-voce examination also, he will not be eligible for the award of the degree, unless he is asked to revise and resubmit the Project by the Board. Head of the Department and program coordinator shall coordinate and make arrangements for the conduct of viva-voce examination. When one does get the required minimum marks both in internal and external evaluations the candidate has to revise and resubmit the dissertation in the time frame prescribed by the PRC. If the report of the examiner is unfavorable again, the project shall be summarily rejected.
- If a student gets a chance to work in industry for one year (placement through internship) then he/she should take permission from Principal, Dean of examinations, Dean of Placements, Dean Academics, Department HOD and program coordinator. He/she should complete the credits in 3rd semester in consultation with course instructor and program coordinator.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. Academic Requirements:

a) A student shall be deemed to have secured the minimum academic requirement in a subject if he / she secures a minimum of 40% of marks in the Semester-end Examination and a minimum aggregate of 50% of the total marks in the Semester-end examination and Internal Evaluation taken together.

b) A student shall be promoted to the next semester only when he/she satisfies the requirements of all the previous semesters.

c) In order to qualify for the award of M.Tech Degree, the student shall complete the academic requirements of passing in all the Courses as per the course structure including Seminars and Project if any.

d) In case a Student does not secure the minimum academic requirement in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-registration, the internal marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, as specified by the College.

e) Grade Points: A 10- point grading system with corresponding letter grades and percentage of marks, as given below, is followed:

Letter Grade	Grade Points	Percentage of marks
O (Outstanding)	10	Marks >= 90
A+ (Excellent)	9	Marks >= 80 and Marks < 90
A (Very Good)	8	Marks >= 70 and Marks < 80
B+ (Good)	7	Marks >= 60 and Marks < 70
B (Above Average)	6	Marks >= 50 and Marks < 60
F (Fail)	0	Marks < 50
Ab (Absent)	0	

Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range O-C. Letter grade 'F' in any Course implies failure of the student in that course and no credits earned.
Computation of SGPA and CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i) **S_k the SGPA of k^{th} semester(1 to 4) is the ratio of sum of the product of the number of credits and grade points to the total credits of all courses registered by a student, i.e.,**

$$SGPA\ (S_k) = \sum_{i=1}^{n} (C_i * G_i) / \sum_{i=1}^{n} C_i$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n is the number of courses registered in that semester.

ii) **The CGPA is calculated in the same manner taking into account all the courses m, registered by a student over all the semesters of a programme, i.e., upto and inclusive of S_k, where $k \geq 2$.**

$$CGPA = \sum_{i=1}^{m} (C_i * G_i) / \sum_{i=1}^{m} C_i$$

iii) The SGPA and CGPA shall be rounded off to 2 decimal points.

13. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M. Tech Degree by JNTUH, he/she shall be placed in one of the following four classes:

	Class Awarded	CGPA Secured
13.1	**First Class With Distinction**	**CGPA ≥ 7.75**
13.2	**First Class**	**CGPA ≥ 6.75 and CGPA < 7.75**
13.3	**Second Class**	**CGPA ≥ 6.00 and CGPA < 6.75**

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for readmission to the same or equivalent subjects as and when they are offered.

17. General Rules

a) The academic regulations should be read as a whole for the purpose of any interpretation. b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision

of the Academic Council is final.

c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.

d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Mechanical Engineering
Design for Manufacturing

I YEAR - I SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	GR18D5118	Advanced Computer Aided Design	3	-	-	3	30	70	100
2	GR18D5119	Advanced Manufacturing Processes	3	-	-	3	30	70	100
3	GR18D5120 GR18D5121 GR18D5122	**Professional Elective-I** 1. Materials Technology 2. Quality Engineering in Manufacturing 3. Precision Engineering	3	-	-	3	30	70	100
4	GR18D5123 GR18D5124 GR18D5125	**Professional Elective-II** 1. Finite Element Applications in Manufacturing 2. Industrial Robotics 3. Material Characterization Techniques	3	-	-	3	30	70	100
5	GR18D5126	Computer Aided Design Lab	-	-	4	2	30	70	100
6	GR18D5127	Advanced Manufacturing Processes Lab	-	-	4	2	30	70	100
7	GR18D5012	Research Methodology and IPR	2	-	-	2	30	70	100
8	Audit	Audit course -1	2	-	-	0	30	70	100
Total			**16**	**-**	**8**	**18**	**240**	**560**	**800**

I YEAR - II SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	GR18D5128	Computer Aided Manufacturing	3	-	-	3	30	70	100
2	GR18D5129	Tool Design	3	-	-	3	30	70	100
3	GR18D5130 GR18D5131 GR18D5132	**Professional Elective-III** 1. Design for Manufacturing and Assembly 2. Design of Hydraulics and Pneumatics Systems. 3. Flexible Manufacturing Systems	3	-	-	3	30	70	100
4	GR18D5133 GR18D5134 GR18D5135	**Professional Elective-IV** 1. Automation in Manufacturing 2. Production and Operation Management 3. Sustainable Manufacturing	3	-	-	3	30	70	100
5	GR18D5136	Computer Aided Manufacturing Lab	-	-	4	2	30	70	100
6	GR18D5137	Tool Design Lab	-	-	4	2	30	70	100
7	Audit	Audit course – 2	2	-	-	0	30	70	100
8	GR18D5190	Mini-Project	2	-	-	2	30	70	100
Total			**16**	**-**	**8**	**18**	**240**	**560**	**800**

II YEAR - I SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	GR18D5138 GR18D5139 GR18D5140	**Professional Elective-V** 1. Advanced Metal Forming 2. Mechatronics 3. Optimization Techniques	3	-	-	3	30	70	100
2	GR18D5201 GR18D5202 GR18D5203 GR18D5204 GR18D5205 GR18D5206	**Open Elective** 1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy	3	-	-	3	30	70	100
3	Dissertation	Dissertation Phase – I	-	-	20	10	30	70	100
Total			**6**	**-**	**20**	**16**	**90**	**210**	**300**

II YEAR - II SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	Dissertation	Dissertation Phase – II	-	-	32	16	30	70	100
Total					**32**	**16**	**30**	**70**	**100**

Audit course 1 & 2

1. English for Research Paper Writing (GR18D5207)
2. Disaster Management (GR18D5208)
3. Sanskrit for Technical Knowledge (GR18D5209)
4. Value Education (GR18D5210)
5. Indian Constitution (GR18D5211)
6. Pedagogy Studies (GR18D5212)
7. Stress Management by Yoga (GR18D5213)
8. Personality Development through Life Enlightenment Skills.(GR18D5214)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED COMPUTER AIDED DESIGN

Course Code: GR18D5118 **L/T/P/C: 3/0/0/3**

Course objectives

- Impart knowledge of Computer Aided Design tools in design of machine components.
- Create Wire-frame, Surface and Solid models for Engineering Components using the CAD system.
- Gain the knowledge of special surfaces and solid model representation techniques to create models of complex products.
- Inculcate collaborative engineering principles in industry or organization.
- Implement Finite Element Methods in analysis of the Engineering components.

Course outcomes

- Illustrate the basic principles of Computer Aided Design tools used in Engineering.
- Develop synthetic curves like cubic curve, Bezier curve, B-spline and NURBS to create wire frame models of engineering products.
- Apply analytical surfaces like plane surface, surface of revolution, tabulated cylinder and synthetic surfaces to create surfaces of engineering products.
- Create the solid model of the object using Boundary representation, Constructive solid geometry, Sweep representation methods. And able to recognize the CAD/CAM exchange formats.
- Analyze a CAD model using Finite Element Method (FEM) and apply collaborative Engineering Principles.

Unit I

CAD Tools: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.

Unit II

Geometric modeling: mathematical description of Analytical curves such as Line, Circle, Ellipse, Parabola etc., and Problems

Wire frame models, wire frame entities parametric representation of synthetic curves, hermite cubic splines, Bezier curves B-splines, rational curves, NURBS, Problems

Unit III

Surface Modeling: Mathematical representation of surfaces, Surface model, Surface entities,

Definition of a Patch, surface representation, parametric representation of surfaces, plane surface, Tabulated Cylinder.

Parametric Representation of Synthetic Surfaces- Hermite Bicubic surface, Bezier surface, B-Spline surface, COON surface, Surface of Revolution, Ruled Surface, Blending surface, Sculptured surface, Surface manipulation—Displaying, Segmentation, Trimming, Intersection, Transformations(both2 D and3D).

Unit IV

Geometricmodelling-3D: Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). Difference between Feature-based and Parametric based modeling, Description of features such as Extrude, Sweep, Loft, Hole, Extrude-cut etc.

CAD/CAM Exchange: Evaluation of data— exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS &DXF.

Unit V

Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis, Pre-processing and Post processing in FEA, Types of Structural, Thermal analysis and Mechanical Assembly.

Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

Text Books

1. CAD/CAM Theory and Practice/lbrahim Zeid/McGraw Hill international.

Reference Books

1. Mastering CAD/CAM/Ibrahim Zeid/ Mc Graw Hill international.
2. CAD/CAM/P.N.Rao/ TMH.
3. CAD/CAM/CIM Radhakrishnan.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED MANUFACTURING PROCESSES

Course Code: GR18D5119 **L/T/P/C: 3/0/0/3**

Course objectives

- Provide the concepts of surface treatments and coatings based on the application of manufacturing processes for materials
- Impart knowledge of manufacturing the component using casting.
- Identify the appropriate welding technique for the joining of materials.
- Expose the unconventional machining processes
- Impart knowledge of manufacturing the component using Additive Manufacturing

Course outcomes

- Provide the concepts of surface treatments and coatings based on the application of manufacturing processes for materials
- Impart knowledge of advanced casting techniques.
- Apply various welding and casting principles in design analysis, aerospace, automotive and other fields
- Explain the working principle of Abrasive Jet Machining, Water jet machining, EDM, ECM.
- Explain fundamentals of additive manufacturing technologies.

Unit I

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, Electro forming, thermal spraying, Ion implantation, diffusion coating, cladding

Unit II

Casting: Investment casting, shell moulding, vacuum casting, counter-gravity casting, squeeze casting, semisolid metal casting: Thixo casting, Rheo casting and SIMA

Unit III

Welding: Introduction friction welding processes, advantages, limitations and applications, processes parameters, Friction welding of similar and dissimilar metals, Friction stir welding process, parameters, tool geometry, applications, friction stir processing, Friction stir welding similar and dissimilar materials, Electron beam welding process Laser beam welding processes, Hybrid welding process, advantages and limitations Defective analysis of friction welded components.

Unit IV

Unconventional Machining process: Introduction to Unconventional machining process, classification, advantages, limitations, and applications. Abrasive Jet Machining, Water jet machining working principle, process, strengths, weaknesses and applications, Electrical Discharge Machining, Electro Chemical Machining, principle, characteristics and applications.

Unit V

Additive Manufacturing: Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, advantages, limitations and applications. Fused deposition Modeling (FDM), Laminated Object Manufacturing (LOM), Selective Laser Sintering (SLS) working principle, process, strengths, weaknesses and applications. Three-dimensional Printing (3DP): Principle, basic process, Physics of 3DP

Text Books

1. R. S. Mishra, *Friction Stir Welding and Processing,* ASM International, 2007.

3. R.K.Rajput, *A Text book of Manufacturing Technology,* Laxmi Publications, New Delhi, 2012.

4. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.

5. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

Reference Books

1. James G Bralla, *Hand Book of Manufacturing Processes*, Industrial Press, New York, 2007

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATERIALS TECHNOLOGY

Course Code: GR18D5120 **L/T/P/C: 3/0/0/3**

Course objectives

- Introduce elastic and plastic behavior of metals and polymers.
- Impart the knowledge on strengthening mechanisms of metals and polymers.
- Analyze the fracture behavior analysis of ductile and brittle materials.
- Gain the skill of identifying the relationship between materials selection and processing for various applications-Case studies.
- Develop the knowledge on composites, super alloys, adhesives, coatings and application of these in aero, auto, Marine, Machinery and Nuclear.

Course outcomes

- Apply core concepts and Analyze materials for design, construction and the importance of lifelong learning.
- Study the fiber and dispersion strengthening mechanisms in materials
- Examine the theories of fracture for brittle and ductile materials.
- Select the best material for particular engineering applications
- Describe the scope of modern metal composites.

Unit I

Elastic And Plastic Behavior : 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

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

Unit IV

Material Selection: Motivation for selection, cost basis and service requirements, selection for mechanical properties, strength, toughness, fatigue and creep. 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.

Unit V

Modern Metallic Materials: Dual Phase Steels, Micro alloyed, High Strength, Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP)Steel, Maraging Steel, Inter metallic, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass Quasi Crystal and Nano Crystalline Materials. Fibres, Foames, Adhesives and coatings, advanced structural ceramics: WC, Tic, Tac, Al_2O_3, Si3N4, CBN, Diamond Properties, processing and applications.

Text Books

1. Mechanical Metallurgy George E Dieter
2. Selection and use of engineering materials Charles J A, Butter worth, Heir maker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

QUALITY ENGINEERING IN MANUFACTURING

Course Code: GR18D5121 **L/T/P/C: 3/0/0/3**

Course objectives

- The concept and techniques of quality engineering manufacturing.
- Demonstrate knowledge of international tolerance in engineering.
- Explain the relationship between customer's desire and satisfaction on quality.
- Study the concepts of ISO 9000 series of quality standards.
- Illustrate when, and be able, to carry out a one way and two way analysis of variance.

Course Outcomes

- Apprehend the fundamentals of quality engineering in manufacturing.
- Illustrate the concept of quality by using quality tools to avoid quality loss.
- Enumerate the techniques to find out the variation in the data and obtain optimal results.
- Apply orthogonal arrays in designing, conducting and analyzing the experiments.
- Apply the international standards (ISO) in quality checks.

Unit I

Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes.
Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type, S-type and L-type)

Unit II

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components.
Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

Unit III

Analysis of Variance (ANOVA): NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

Unit IV

Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, s teps in designing, conducting and analyzing an experiment.

Interpolation of Experimental Results: Interpretation methods, percent contribution, estimating the mean.

Unit V

Quality: ISD-9000 Quality System, BDRE, 6-sigma, Bench making, Quality circles, Brain Storming, Fishbone diagram, problem analysis.

Text Books

1. Taguchi Techniques for Quality Engineering /Phillip J.Ross /McGraw Hill, Intl.II Edition,1995.

Reference Books

1. Quality Engineering in Production systems/ G.Taguchi, A.Elsayedetal/ Mc.Graw Hill Intl.Edition, 1989.
2. Taguchi Methods explained: Practical steps to Robust Design/ Papan P.Bagchi /Prentice Hall Ind. Pvt. Ltd., New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRECISION ENGINEERING

Course Code: GR18D5122 **L/T/P/C: 3/0/0/3**

Course objectives

- Introduction to concepts of accuracy, geometric dimensioning, tolerancing, Datum's creation, process capability.
- Representation and application of geometric dimensioning, surface finish and tolerance.
- Draw process drawings for different operations and tolerance work sheets.
- Summarize machining considerations during manufacturing.
- Processing of nanotechnology, working of surface-mechanical, optical and CMM measuring systems.

Course outcomes

- Reproduce process drawings, tolerance worksheets and tolerance zone conversions.
- Demonstrate mechanical measuring system processing to find dimensional accuracy and surface finish.
- Interpret the overall performance with tolerance analysis.
- Compute errors due to compliance of machine-fixture-tool-work piece (MFTW) System
- Make use of measuring systems to check the dimensional quality and surface finish of the product.

Unit I

Tolerance and fits: ISO and ISI designation, calculation of clearance and interference fits, probability of clearance and interference fits in transitional fits, examples of applications of various fits, concept of selective assembly, calculation of fits in selective assembly.

Unit II

Concept of part and machine tool accuracy: Accuracy specification of parts and assemblies, accuracy of machine tools, alignment testing of machine tools.

Unit III

Theory of dimensional chains: Definitions, concept of dimensional chain or tolerance stack, Examples of right and wrong dimensioning. Basic theory of dimensional chains. Calculation of tolerances in dimensional chains.

Unit IV

Errors during machining: Errors due to compliance of machine-fixture-tool-work piece (MFTW) System, influence of compliance on progressive decrease of error in a series of machining operations, theory of location, location errors, errors due to geometric Inaccuracy of machine tool, errors due to tool wear, errors due to thermal effects, errors due to clamping. Statistical method of accuracy analysis.

Unit V

Surface roughness: Definition and measurement of surface roughness indicators, (CLA, RMS, etc,.) and their comparison, influence of machining conditions, methods of obtaining high quality surfaces, Lapping, Honing, Super finishing and Burnishing processes.

Text Books

1. R.L.Murty,"Precision Engineering in Manufacturing", New Age International Publishers, 1996.
2. V.Kovan, "Fundamentals of Process Engineering", Foreign Languages Publishing House, Moscow, 1975

Reference Books

1. Eary, D.F. and Johnson, G.E. *Process engineering for manufacturing*. Prentice Hall. 1962
2. J.L.Gadjala, "Dimensional control in Precision Manufacturing", McGraw Hill Publishers

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FINITE ELEMENT APPLICATIONS IN MANUFACTURING

Course Code: GR18D5123 **L/T/P/C: 3/0/0/3**

Course objectives

- Gain a fundamental understanding of the finite element method for solving boundary value problems.
- Analyze important concepts of variational form, minimum potential energy principles, and method of weighted residuals.
- Derive one dimensional problems such as truss, beam, and frame members, two-dimensional problems such as plain stress and plain strain elasticity problems, torsion problem.
- Introduce the finite element analysis of static and dynamic problems and heat transfer problems and manufacturing processes.
- Analyzing skills in applying basic laws in mechanics and integration by parts to develop element equations and steps used in solving the problem by finite element method.

Course outcomes

- Obtain an understanding of the fundamental theory of the FEA method
- Apply the concepts of minimum potential energy principles to solve one dimensional structural problems
- Develop the ability to generate the governing FE equations for systems governed by partial differential equations
- Obtain finite element solution and compare with exact solution of simple one-dimensional problems.
- Apply the finite element procedure for stress analysis and design of load carrying structures and heat transfer problems and manufacturing processes.

Unit I

Introduction: Fundamentals–Initial, boundary and Eigen value problems–weighted residual, Galerkin and Raleigh Ritz methods-Integration by parts–Basics of variational formulation – Polynomial and Nodal approximation.

Unit II

One Dimensional Analysis: Steps in FEM–Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing–One dimensional analysis in solid mechanics and heat transfer.

Unit III

Shape Functions And Higher Order Formulations: Shape functions for one and two dimensional elements-Three nodded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis– Isoperimetric elements–Jacobian matrices and transformations–Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

Unit IV

Computer Implementation: Pre-Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics–Solution and post processing–Overview of application packages–Development of code for one dimensional analysis and validation.

Unit V

Analysis of Production Processes: FE analysis of metal cutting, Basic concepts of plasticity and fracture–Solid and flow formulation–small incremental deformation formulation–Fracture criteria–FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency–FE analysis of welding.

Text Books

1. Reddy, J.N. An Introduction to the Finite Element Method, Mc Graw Hill, 1985.
2. Rao, S.S., Finite Element method in engineering, Pergamm on press,1989.
3. Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990.

Reference Books

1. Kobayashi, S,Soo-ik-Oh and Altan, T,Metal Forming and the Finite Element Methods, Oxford University Press, 1989.
2. Lewis R.W.Morgan, K,Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley,1994.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDUSTRIAL ROBOTICS

Course Code: GR18D5124 **L/T/P/C: 3/0/0/3**

Course objectives

- The Objective of this course is to provide the student to
- Familiar with the automation and applications of robotics.
- Proficient with the fundamental concepts of kinematics of robots.
- Emphasize the concepts about robot End-effectors, various sensors used in robots and machine vision.
- Introduce Robot Programming methods & Languages of robot.
- Incorporate knowledge about various robots, robot cell design and their applications in material transfer, loading and unloading etc.

Course outcomes

- Familiarized with the Robot Anatomy and Robot configurations.
- Skilled with the principles of kinematic of robot.
- Develop sound knowledge about robot end effectors and machine vision concepts.
- Nurtured with the Programming methods & various Languages of robots.
- Acquainted with the concepts of Robot cell design control and various applications of robots in various fields.

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. Control System and Components: basic concept and modals controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

Unit II

Motion Analysis And Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

Unit III

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design Sensors: Desirable features, tactile, proximity and range sensors, uses sensors in robotics. 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 IV

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations. Robot Languages: Textual robot languages, Generation, Robot language structures, Elements in function.

Unit V

Robot Cell Design and Control: Robot cellayouts- Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Interlocks, Error detection, Work cell controller. Robot Application: Material transfer, Machine loading/ unloading Processing operation, Assembly and Inspection, Feature Application.

Text Books

1. Industrial robotics, MikellP.Groover /McGrawHill.

Reference Books

1. Robotics,K.S.Fu/McGraw Hill.

2. Yoram Koren,"Robotics for Engineers' Mc Graw-Hill, 1987.

3. Kozyrey,Yu. "Industrial Robots", MIR Publishers Moscow, 1985.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATERIAL CHARACTERIZATION TECHNIQUES

Course Code: GR18D5125 **L/T/P/C: 3/0/0/3**

Course objectives

- Provide the students, knowledge on basics of material characterization and various optical microscope techniques.
- Impart knowledge on electron microscopy techniques, its functions and working principles.
- Inculcate the concepts on diffraction methods and various diffraction techniques.
- Analyze the metal surfaces using advanced microscopic techniques.
- Expose knowledge on spectroscopy techniques and its various types on metal surfaces.

Course outcomes

- Apply appropriate characterization techniques for microstructure examination at different magnification level and use them to understand the microstructure of various materials
- Know the basic operational modes of SEM and TEM
- Explain the principles of diffraction (Bragg's Law) and its use in crystal structure determination.
- Explain the application of various equipment's for surface analysis
- Use appropriate spectroscopic technique to measure vibrational / electronic transitions to estimate parameters like energy band gap, elemental concentration, etc.

Unit I

Introduction: Need of materials characterization and available techniques.

Optical Microscopy: Optical microscope - Basic principles and components, Different examination modes (Bright field illumination, Oblique illumination, Dark field illumination, Phase contrast, Polarised light, Hot stage, Interference techniques), Stereomicroscopy, Photo-microscopy, Colour metallography, Specimen preparation, Applications.

Unit II

Electron Microscopy: Interaction of electrons with solids, Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM) and specimen preparation techniques, Scanning transmission electron microscopy, Energy dispersive spectroscopy, Wavelength dispersive spectroscopy.

Unit III

Diffraction Methods: Fundamental crystallography, Generation and detection of X-rays, Diffraction of X-rays, X-ray diffraction techniques, Electron diffraction.

Unit IV

Surface Analysis: Atomic force microscopy, scanning tunneling microscopy, X-ray photoelectron spectroscopy.

Unit V

Spectroscopy: Atomic absorption spectroscopy, UV/Visible spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy.

Text Books

1. Tyagi, A.K., Roy, Mainak, Kulshreshtha, S.K., and Banerjee, S., Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series), Volumes 49 – 51, (2009).
2. Wachtman, J.B., Kalman, Z.H., Characterization of Materials, Butterworth-Heinemann, (1993).

Reference Books

1. Li, Lin, Ashok Kumar Materials Characterization Techniques Sam Zhang; CRC Press, (2008).
2. Cullity, B.D., and Stock, R.S., "Elements of X-Ray Diffraction", Prentice-Hall, (2001).
3. Murphy, Douglas B, Fundamentals of Light Microscopy and Electronic Imaging, Wiley-Liss, Inc. USA, (2001).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER AIDED DESIGN LAB

Course Code: GR18D5126 **L/T/P/C: 0/0/4/2**

Course objectives

- Provide knowledge to Model 3D parts using CAD software.
- Apply CAD software in creating assembly of machine components.
- Confer about Importance of parametric curves to model complex machine parts.
- Provides knowledge about different layouts of drawings, orthographic projections.
- Introduces various file formats.

Course outcomes

- Create complex geometry of machine components.
- Create engineering assemblies using appropriate assembly constraints.
- Model complex parts using Parametric curves.
- Develop solutions in the field of Design and simulation in mechanical engineering applications.
- Create detailed drawing for parts and assemblies of engineering components.

Introduction to CAD Software

Part Modeling

to create 3D Part models using features such as Extrude, Revolve, fillets, chamfer, Sweep, Loft, Hole, Extrude-cut, etc.

Assembly of Parts

To create an Assembly of parts by applying constraints (relations/ Mates)

Modeling of complex Parts and surfaces

To create complex 3D parts and surfaces using parametric curves

Drafting

To create layout, orthographic views, detailing

Exercises in Modeling, Assembly, and Drafting

Task 1: Creating Parts related to Shock Assembly

Task 2: Creating Parts related to Quick Acting Hold-Down Clamp

Task 3: Assembly of Shock Assembly

Task 4: Assembly Quick Acting Hold-Down Clamp

Task 5: Part and Assembly Drawings of Shock Assembly

Task 6: Part and Assembly Drawings of Quick Acting Hold-Down Clamp

Task 7: Practice Exercise related to Advanced Feature Options

Task 8: Practice Exercise related to Surface modeling

Task 9: Create an Aerofoil section of an aircraft wing using parametric curves

Task 10: Create a Turbine blade profile using parametric curves

Finite Element Analysis

Task 11: Structural analysis of a beam element

Task 12: Thermal analysis of a Composite Slab

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED MANUFACTURING PROCESS LAB

Course Code: GR18D5127 **L/T/P/C: 0/0/4/2**

Course objectives

- Provides information about the workflow process of a 3D printer.
- Interpret advantages of 3D printing technology over conventional manufacturing processes.
- Applications of 3D printers in various fields.
- Introduce practical usage of unconventional machining process.
- Familiarize tribological characterization of ferrous and non-ferrous materials.

Course outcomes

- Manufacture complex parts using Additive manufacturing.
- Understand optimization of production time in material handling.
- Understand the motions of drives in CNC machines.
- Analyze experimental data to derive valid conclusions.
- Acquire knowledge in un-conventional machining process.

Task 1: Fabrication of a vertebra using 3D- Printing

Task 2: Fabrication of a bevel gear using 3D- Printing

Task 3: Fabrication of turbine blade using 3D- Printing

Task 4: Material handling simulation of shop floor layout and determination of process time–Model 1

Task 5: Material handling simulation of shop floor layout and determination of process time–Model 2

Task 6: Material handling simulation of shop floor layout and determination of process time–Model 3

Task 7: Material handling simulation of shop floor layout and determination of process time–Model 4

Task 8: X-Y Table motion control with varying velocity and acceleration on LSM controller

Task 9: Demonstration of double acting pneumatic drive and rotation of synchronized motors on LSM controller.

Task 10: Pin on disc based tribological characterization of ferrous materials

Task 11: Pin on disc based tribological characterization of non-ferrous materials

Task 12: Demonstration of the various features of unconventional machining-Electro Discharge Machining

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

RESEARCH METHODOLOGY AND IPR

Course Code: GR18D5012 **L/T/P/C: 2/0/0/2**

Course objectives

- Provide knowledge on research problems and approaches of investigation of solutions for research problem.
- Analyze on literature surveys and to have idea about research ethics.
- Create a research document with effective technical writing.
- Impart knowledge on Intellectual Property Rights, Procedure for grants of patents and Patenting.
- Apply for Patent Rights, Licensing and transfer of technology.

Course outcomes

- Understand research problem formulation.
- Analyze research related information.
- Follow research ethics.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- To implement innovative research work and patent it.

Unit I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit II

Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Reference Books

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'" Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
2. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
3. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
4. Mayall , "Industrial Design", McGraw Hill, 1992.
5. Niebel , "Product Design", McGraw Hill, 1974.
6. Asimov, "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER AIDED MANUFACTURING

Course Code: GR18D5128 **L/T/P/C: 3/0/0/3**

Course objectives

- To apply CNC and APT programming knowledge in Manufacturing of machine members.
- To understand the working and constructional features of CNC Machine tools, DNC, and Adaptive control system.
- To understand the concept of post processors of CNC machines and its functions
- To understand hardware of microcontrollers and PLC system.
- To create the process plans of machine members and to analyze the quality of product using advanced inspection and testing instruments.

Course outcomes

- Apply knowledge of CNC and APT programming in manufacturing of machine members of automobile industry, machine tools, aerospace etc.
- Apply the knowledge of CNC machine tools and its features in efficient use of the machine.
- Understand the working principle of post processors, its hardware and its functions.
- Understand basic principles of micro controllers, its hardware, programming, PLC hardware and its application to CNC machines.
- Create process plans using the software for machine components. Analyze the machine components using advanced inspection and testing instruments for controlling the quality and Understand the knowledge of expert systems like Artificial Intelligence.

Unit I

Computer aided programming: General information. APT Programming , Examples Apt programming problems (2D machining only).NC programming on CAD/CAM systems, the design and implementation of post processors Introduction to CAD/ CAM software, Automatic Tool Path generation.

Unit II

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system. Modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control Introduction type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization. Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

Unit III

Post Processors for CNC: Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP, based, Post Processor

Communication channels and major variables In the DAPP- based Post Processor, the creation of a DAPP- Based Post Processor.

Unit IV

Micro Controllers: Introduction. Hardware components, I/O pins, external memory, counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded controllers. Applications and Programming of Micro Controllers. Programming Logic Controllers (PLC's): Introducation, Hardware Components of PLC System, basic structure, principle of operations, programming mnemonics timers, Internal relays and counters Applications of PLC's in CNC Machines.

Unit V

Computer Aided Process Planning, Hybrid CAAP System, Computer Aided Inspection and quality control. Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods. Artificial Intelligence and expert system; Artificial Neural Networks, Artificial Intelligence in CAD. Experts systems and its structures.

Text Books

1. Computer Control of Manufacturing Systems / YoramKoren / McGraw Hill. 1983.

2. Computer Aided Design Manufacturing, K. LalitNarayn, K. Mallikarjuna Rao and MMM SarearPHI 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

TOOL DESIGN

Course Code: GR18D5129 **L/T/P/C: 3/0/0/3**

Course objectives

- Inculcate the selection of best cutting tool material for machining.
- Impart knowledge in measuring the cutting forces in machining.
- Impart knowledge of selection and design of single point cutting tool.
- Impart knowledge in Design of die and punch for blanking, piercing and bending operations.
- Inculcate the principle of jigs and fixtures for holding the work piece.

Course outcomes

- Learn the importance of selecting the proper cutting tool material and cutting tool angles required to machine a work piece. Identify the applications of various types of cutting tool materials for engineering applications.
- Identify various tool wear mechanisms for various types of machining process. Select cutting fluids, cutting tool materials and tool geometry for improving machinability.
- Select the right tool material for making dies depending upon the tonnage required for the particular operation.
- Design of die and punch for blanking, piercing, drawing and bending operations.
- Design a location and clamping system for a given component.

Unit I

Tool Materials: Introduction desirable properties of tool materials, Types of Cutting Tool Materials, Indexable inserts, Coated tools, Orthogonal and Oblique cutting, Classifications of cutting tools, Chip formation, Types of chips, Cutting tool geometry, various methods of tool nomenclature and their relationships. Theoretical Determination of shear angle and cutting forces Shear plane theory – Merchant's models, Lee and Shaffer's model. Velocity relationships, Work done in cutting. Analysis of cutting forces using MerchantCircle diagram.

Unit II

Tool Life and Tool Wear: Theories of tool wear-adhesion, abrasive and diffusion wear mechanisms, forms of wear, Taylor's tool life equation, Tool life criteria and machinability index.

Cutting Temperature: Sources of heat in metal cutting, influence of metal conditions. Temperature distribution, zones, Use of tool work thermocouple for determination of temperature. Temperature distribution in Metal Cutting.

Unit III

Forging Die Design: Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies, Forging design factors – Draft, fillet & Corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation- fullering, edging, bending, drawing, flattering, blacking finishing , cutoff. Die design for machine forging – determination of stock size in closed & open die forging. Tools for flash trimming &hole piercing, materials & manufacture of forging dies

Unit IV

Press Tool Design: Introduction, press operations, Press working equipment – Classification, Press working Terminology, Types of dies – Simple dies, Inverted dies, Compound dies, Combination dies, Progressive dies, Transfer dies. Principle of metal cutting, strip layout, clearance, angular clearance, cutting forces, method of reducing cutting forces, die block, die block thickness, Strippers, Stoppers, Stock stop, Stock guide, Knock outs, Pilots. Blanking & Piercing die design-single & progressive dies.

Unit V

Design of Jigs and fixtures

Work holding devices: Basic principle of six-point location, Locating methods and devices, Principle of clamping and Types of clamps.

Design of jigs: Type of Drill bushes, Classification of drill jigs, Design of drill jigs.

Design of fixtures: Design of milling fixtures, Design of turning fixtures.

Text Books

1. A.Bhattacharya- Metal Cutting Theory and Practice, New Central Book Agency (P) Ltd.
2. Donaldson.C, G.H.Lecain and V.C.Goold “Tool Design” Tata McGraw Hill Publishing company ltd, New Delhi, 2010.

Reference Books

1. F.W.Wilson. F.W. "Fundamentals of Tool Design” ASME, Prentice Hall of India, New Delhi, 2010.
2. Boothroyd,G., “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 1985

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN FOR MANUFACTURING AND ASSEMBLY

Course Code: GR18D5130 **L/T/P/C: 3/0/0/3**

Course objectives

- Introduce the basics of design concepts and selection of materials while assembly.
- Provide knowledge on design considerations for various manufacturing processes.
- Impart knowledge on design criteria's to be considered while welding and forging processes.
- Inculcate the design concepts to be followed in extrusion, sheet metal and plastics processing.
- Analyze the design criteria's to be considered during Manual assembly and handling of machined components.

Course Outcomes

- Understand the quality aspects of design for manufacture and assembly. Apply Boothroyd method of DFM for product design and assembly.
- Apply the concept of DFM for casting, welding, forming and assembly.
- Apply the metal joining processes
- Identify the design factors and processes as per customer specifications.
- Apply principles of DFA to increase manufacturing efficiency in assembly processes Apply quantitative methods to assess DFA between different designs.

Unit I

Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design, Materials: Selection of Materials for design – Developments in Material Technology – Criteria for material selection – Material selection interrelationship with process selection –process selection charts.

Unit II

Machining Process: 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 Metal Casting: Appraisal of various casting processes, Selection of casting process, General design considerations for casting – Use of Solidification Simulation in casting design– Product design rules for sand casting.

Unit III

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. Forging – Design factors for Forging – Closed die forging design – Location of parting lines of dies – Drop forging die design – General design recommendations

Unit IV

Extrusion, Sheet Metal Work & Plastics: Design guidelines for Extruded sections - Keeler Goodman Forming Limit Diagram – Component Design for Blanking. Plastics: Visco elastic and Creep behavior in plastics – Design guidelines for Plastic components – Design considerations for Injection Moulding.

Unit V

Design For Assembly (DFA): General design guidelines for Manual Assembly- Development of Systematic DFA Methodology- Assembly Efficiency- Classification System for Manual handling- Classification System for Manual Insertion and Fastening- Effect of part symmetry on handling time- Effect of part thickness and size on handling time- Effect of weight on handling time- Effect of symmetry , Further design guidelines.

Text Books

1. Engineering design-Material & Processing Approach/ George E. Deiter, Mc. Graw Hill Intl. 2nd Ed.2000.
2. Product design for Manufacture and Assembly/ Geoffrey Boothroyd/Marcel Dekker Inc NY, 1994.

Reference Books

1. Product design and Manufacturing / A.K Chitale and R.C Gupta / Prentice – Hall of India, New Delhi, 2003.
2. Design and Manufacturing / Surender Kumar &GouthamSutradhar / Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.
3. Hand Book of Product Design/ Geoffrey Boothroyd Marcel Dekken Inc. NY, 1990.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF HYDRAULICS AND PNEUMATIC SYSTEMS

Course Code: GR18D5131 **L/T/P/C: 3/0/0/3**

Course objectives

- Impart the students, the basic concepts of hydraulic and pneumatic systems.
- Expose the students with various hydraulic and pneumatic actuators.
- Provide knowledge on fluid power systems and its applications to real time.
- Analyze the problem, that occurs in fluid power systems and take necessary troubleshooting maintenance activities.
- Get practiced in designing hydraulic and pneumatic systems.

Course outcomes

- Gain knowledge on hydraulic and pneumatic system concepts.
- Differentiate between various pumps and actuators.
- Determine the components and accessories required in constructing a hydraulic power pack.
- Design hydraulic & pneumatic circuits for the required applications.
- Gain skills on hydraulic and pneumatic power pack with its components and accessories.

Unit I

Introduction to fluid power systems, merits, demerits &Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids, Types of fluids, Pascal's Law, Effect of temperatures, fluid power system elements and their representation in the circuits. Comparison of Mechanical, Electrical, Hydraulic & Pneumatic systems.

Unit II

Classification of Pumps, Gear Pump, Vane Pump, piston Pump, bent axis in line piston pumps. Internal and external Gear pumps. Selection and specification of Pumps. Actuators: linear Actuators, Cushioning, Seals, Mounting details, Rotary Actuators.

Unit III

Elements of Power pack, Heating and cooling systems for Hydraulic Power pack, Directional control valves, check valve, pressure control valve, Flow control valve, solenoid valves, Servo controlled valves, Accumulators, Types of accumulators, intensifier &Hydro Pneumatic circuits.

Unit IV

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit, muffler Unit, Meter-in circuit, Meter-out circuit, Bleed off circuits, counter balance circuit, Sequential

circuit design for simple applications using cascade method, synchronizing circuits.

Unit V

Hydraulic and Pneumatic equipment in Automation, Low Cost Automation, fluidic sensors, PLC – PLC Circuits in automation, Trouble shooting of various Hydraulic & Pneumatic equipment's, causes and remedies, Hydraulic and Pneumatic Equipment maintenance activities.

Text Books

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems Principles and Maintenance", T a t aMcGraw-Hill, 2001.

Reference Books

1. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
2. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
3. Majumdar S.R., "Pneumatic systems, Principles and maintenance", Tata McGraw Hill, 1995

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLEXIBLE MANUFACTURING SYSTEMS

Course Code: GR18D5132 **L/T/P/C: 3/0/0/3**

Course objectives

- Expose their knowledge on flexible manufacturing system and its importance.
- Design a good FMS Layout in the industry.
- Impart knowledge on various FMS machining centres and inspection methods.
- Inculcate concepts on material handling and the various methods of material handling to real time applications.
- Implement various FMS management techniques in a industry and improve the profit/ productivity.

Course outcomes

- Gain knowledge on concepts of flexible manufacturing systems.
- Design and create an innovative layout for flexible manufacturing.
- Explain processing stations and inspection process carried out in FMS environments.
- Develop material handling systems for the required application.
- Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

Unit I

Introduction to Flexible Manufacturing Systems**,** Understanding FMS, Types of Manufacturing Systems, Definition, objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push type, Planning and scheduling and control of FMS, Knowledge based scheduling.

Unit II

Classification Of FMS Layout**,** FMS: Layouts and their Salient features, Single line layout, dual line layout, loop layout, ladder layout, robot centre type layout, merits, demerits and applications..

Unit III

Processing Stations**,** Salient features Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station

Unit IV

Material Handling System**,** Introduction and need for material handling system, Types of material handling system, merits and demerits of various material handling system, Conveyors, Robots, Automated Guided Vehicle(AGV), Automated Storage Retrieval System (ASRS). Kanban systems.

Unit V

FMS Management Technology, Tool Management, Tool Magazine, Tool Preset, Identification, Tool Monitoring and Fault Detection, Planning and Routing, Production Planning and Control, Scheduling and loading of FMS, Various Types of Maintenance Activities.

Text Books

1. William W Luggen, "Flexible Manufacturing Cells and System" Prentice Hall of Inc New Jersey, 1991.
2. Groover,M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009

Reference Books

1. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.
2. Production System leyond Large Scale Production/ TalichiOhno/ Toyota Productivity Press India Pvt.
3. Flexible Manufacturing Systems/ H K Shivanand/New Age International/2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

AUTOMATION IN MANUFACTURING

Course Code: GR18D5133 **L/T/P/C: 3/0/0/3**

Course objectives

- Introduce the fundamental concepts of automation in manufacturing.
- Impart the knowledge on design and fabrication of automated flow lines.
- Gain the skill of analysis and implementation on transfer lines.
- Prioritize the line balancing methods in automated assembly systems.
- Inculcate knowledge on analysis of automated material handling systems in automation.

Course Outcomes

- Identify the manufacturing tools, solutions to industrial applications.
- Visualize the automation systems and take up multi-disciplinary tasks. Analyze the impact of automation in engineering solutions for society in global and economic context.
- Design and construct automated flow lines for simple products.
- Classify the various manufacturing cells.
- Select the various material handling systems used in advanced automation systems.

Unit I

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation, automation reasons, Production operations and automation strategies, Plant Layout, Production concepts and mathematical models, design the parts for automation, Automatic loading systems.

Unit II

High volume production systems: Automated flow lines. Methods of work flow, transport transfer mechanism buffer storage, Control functions, Automation for machining operations Design and fabrication considerations.

Unit III

Analysis of Automated Flow Lines: Analysis of transfer lines without storage, partial automation automated flow lines with storage buffers implementing of automatic flow lines, Line balancing problems, Considerations in assembly line design.

Unit IV

Assembly Systems and Line Balance: Manual assembly lines, line balancing problem, methods of line balancing, ways to improve line balancing, flexible manual assembly lines, automated assembly systems, analysis of multi station assembly, manufacturing Cells, Automated Cells, Analysis of single station cells.

Unit V

Automated Material Handling: Types of equipment and functions, design and analysis of material handling system, conveyor system. Automated guided vehicle system, components operation, types, design of automated guided vehicles and applications. Automated storage and Retrieval systems, types, basic components and applications. Transfer lines, Design for Automated Assembly, Partial Automation, Communication Systems in Manufacturing.

Text Books

1. Mikell.P.Groover "Automation, Production Systems and CIM", PHI Pvt., Ltd, 1998.

Reference Books

1. P. Radha Krishan & S. Subrahamanyan and Raju "CAD/CAM/CIM', New Age International Pub, 2003
2. Singh, "System Approach to Computer Integrated Design and Manufacturing', John Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRODUCTION AND OPERATIONS MANGEMENT

Course Code: GR18D5134 **L/T/P/C: 3/0/0/3**

Course objectives

- Introduction to the technical design and manufacturing operations and supply management to the sustainability of an enterprises.
- Import the basic principles of Project management and other business functions, such as human resources, purchasing, marketing, finance, etc.
- Distinguish the Just in Time principles and PERT techniques to reduce the lead time in production.
- Analyse the new demands of the globally competitive business environment that supply chain managers face today.
- Creation of the innovative technological tools to improve quality of production.

Course outcomes

- Demonstrate the operations and supply management to the sustainability of an Enterprise. Interpret the basic principles of Project management.
- Identify various Production and Plant layouts.
- Apply the Just In time (JIT) basic principles and applications.
- Recommend the production schedule for productivity.
- Adapt PERT Technique to reduce the lead time in production.

UNIT I

Operation Management, Definition, Objectives, Types of Production systems, historical development of operations management, Current issues in operation management. Product design, Requirements of good product design, product development, approaches, concepts in product development, standardization, simplification, Speed to market, Introduction to concurrent engineering.

Unit II

Value engineering, objective, types of values, function &cost, product life cycle, steps in value engineering, methodology in value engineering, FAST Diagram, Matrix Method. Location, Facility location and layout, Factors considerations in Plant location, Comparative Study of rural and urbansites, Methods of selection plant layout, objective of good layout, Principles, Types of layout, line balancing.

Unit III

Aggregate Planning, definition, Different strategies, various models of Aggregate Planning, Transportation and graphical models. Advance inventory control systems push systems, Material Requirement, Terminology, types of demands, inputs to MRP, techniques of MRP, Lotsizingmethods, benefits and drawbacks of MRP, Manufacturing Resources Planning (MRP,II), Pull systems ,VsPush system, Just in time (JIT) philosophy Kanban system, Calculation of number of kanbansRequirements for implementation JIT**,** JIT Production Process, benefits of JIT.

Unit IV

Scheduling, Policies, Types of scheduling, Forward and Backward Scheduling, Grant Charts, Flow shop Scheduling, n jobs and 2machines, n jobs and 3 machines, job shop Scheduling, 2 jobs and n machines , Line of Balance.

Unit V

Project Management, Programming Evaluation Review Techniques (PERT), three times estimation, critical path, Probability of completion of project, critical path method, crashing of simple nature.

Text Books

1. "Operation Management" by E.s.Buffs
2. "Operation Management "Theory and Problems :byJosephG. Monks

Reference Books

1. "Production Systems Management" by JamesI. Riggs.
2. "Productionand Operation Management"byChary.
3. " Operations Management" by chase
4. " Production and Operation Management" by pannerSelvam
5. "Producationand Operation Analysis" by Nahima

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SUSTAINABLE MANUFACTURING

Course Code: GR18D5135 **L/T/P/C: 3/0/0/3**

Course objectives

- Provide knowledge on Sustainable Manufacturing, its Scope, Need and Benefits.
- Expose the students with various Tools and Techniques of Sustainable Manufacturing.
- Impart knowledge on Environmental Impact Assessment towards sustainable manufacturing.
- Design Eco friendly products and to have knowledge on various recycling methods.
- Implement idea towards frameworks for measuring sustainability.

Course outcomes

- Explain the importance of sustainable development.
- Identify the link between manufacturing process models and sustainable manufacturing metrics for product and process improvement
- Understand the three pillars of sustainability and how they are manifested in sustainable manufacturing.
- Incorporate economic, environmental, and social aspects into decision making processes using multi-criteria decision-making methods.
- Exhibit competence on the usage and applicability of sustainability tools. Compute sustainability performance through the indicators.

Unit I

Concepts of sustainability and sustainable development – Need for sustainable development - Components of sustainability- Social, Economic, Environmental dimensions - Linkages between technology and sustainability - Sustainable Manufacturing –Scope, Need and Benefits.

Unit II

Tools and Techniques of Sustainable Manufacturing – Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, Design for Disassembly -Sustainable Product Development – Various Phases.

Unit III

EIA Methods –CML, EI 95 and 99, ISO 14001 EMS and PAS 2050 standards, Environmental Impact parameters - Interactions between energy and technology and their implications for environment and sustainable development.

Unit IV

Design for recycling – Eco friendly product design methods – Methods to infuse sustainability in early product design phases – Multi-Criteria Decision Making in Sustainability.

Unit V

Frameworks for measuring sustainability- Indicators of sustainability – Environmental, Economic, Societal and Business indicators - Concept Models and Various Approaches, Product Sustainability and Risk/Benefit assessment– Corporate Social Responsibility.

Text Books

1. G. Atkinson, S. Dietz, E. Neumayer, — "Handbook of Sustainable Manufacturing". Edward Elgar Publishing Limited, 2007.

References Books

1. D. Rodick, "Industrial Development for the 21st Century: Sustainable Development Perspectives", UN New York, 2007.
2. Rogers, P.P., Jalal, K.F. and Boyd, J.A., "An Introduction to Sustainable Development", Earthscan, London, 2007.
3. P. Lawn, "Sustainable Development Indicators in Ecological Economics", Edward Elgar Publishing Limited.
4. S. Asefa, "The Economics of Sustainable Development", W.E. Upjohn Institute for Employment Research, 2005

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER AIDED MANUFACTURING LAB

Course Code: GR18D5136 **L/T/P/C: 0/0/4/2**

Course objectives

- Gain the knowledge of CNC programming.
- Simulate the CNC programs.
- Inculcate the constructional features of CNC machines.
- Produce the machine components using CNC machines.
- Implement CAM software for automatic generation of programs.

Course outcomes

- Illustrate the constructional features of Computer Numerical Control (CNC) Lathe and Milling Machines.
- Identify various G-codes and M-codes related to NC Part programming.
- Acquire programming skills to create components using CNC machine.
- Simulate the machining process involved in the creation of engineering components
- Produce complex parts using various canned cycles.

Task 1: Creating a job on CNC Turning machine using G90 cycle

Task 2: Creating a job on CNC Turning machine using G94 cycle

Task 3: Creating a job on CNC Turning machine using G70-G71 cycle

Task 4: Creating a job on CNC Turning machine using G70-G71 cycle

Task 5: Creating a job on CNC Turning Machine using G70-G71 cycle and Drilling-G74cycle

Task 6: Creating a job on CNC Turning Machine using Grooving-G75, and Threading-G76 cycles

Task 7: Creating a job on CNC Turning Machine using G70-G71, Drilling-G74, Grooving-G75, and Threading-G76 cycles

Task 8: Creating a job on CNC Milling Machine using Linear Interpolation Codes

Task 9: Creating a job on CNC Milling Machine using Circular Interpolation Codes

Task10: Creating a job on CNC Milling Machine using Linear Interpolation and Circular Interpolation Codes

Task 11: Creating a job on CNC Milling Machine using Spot-drilling cycle

Task 12: Creating a job on CNC Milling Machine using threading cycle

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

TOOL DESIGN LAB

Course Code: GR18D5137 **L/T/P/C: 0/0/4/2**

Course objectives

- To demonstrate the fundamentals of machining processes.
- To develop knowledge and importance of cutting force dynamometer.
- To develop fundamental knowledge on tool materials and tool life.
- To develop knowledge on surface roughness in turning.
- Develop knowledge in simulation techniques.

Course outcomes

- Acquire knowledge on various machining processes in turning. Estimate the chip reduction coefficient and shear angle.
- Measure cutting forces in turning process.
- Estimate tool life of a single point cutting tool.
- Evaluate the effect of the process parameters on surface roughness.
- Gain knowledge in simulation techniques. Analyze experimental data to derive valid conclusions.

Task 1

Estimation of various cutting forces in orthogonal turning using Lathe tool dynamometer on ferrous materials

Task 2

Estimation of various cutting forces in orthogonal turning using Lathe tool dynamometer on Non-ferrous materials

Task 3

Estimation of Specific cutting energy in turning Process carried on Precision lathe.

Task 4

Estimation of chip reduction coefficient and shear angle in orthogonal turning.

Task 5

Estimation of Material Removal Rate in turning process

Task 6

Estimation of tool life of a single point cutting tool using Tool makers Microscope for ferrous materials.

Task 7

Estimation of tool life of a single point cutting tool using Tool makers Microscope for non- ferrous Materials.

Task 8

Evaluation of the effect of process parameters by measuring surface roughness using surf test

Task 9

Simulation of oblique turning process

Task 10

Simulation of orthogonal turning process

Task 11

Study on the effect of various parameters and various angles in single point cutting tool.

Task 12

Study on conversions of angles between ASA and ORS systems.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED METAL FORMING

Course Code: GR18D5138 **L/T/P/C: 3/0/0/3**

Course objectives

- Make students learn the important theoretical forming concepts, and the state-of-the-art technological developments in the area of modern metal forming operations.
- Understand bulk forming and sheet metal forming processes.
- Analyse various metal forming processes to decide their application in the given situation.
- Make the student conversant with various press tool design and special features of machine tool design for forming operations.
- learn introductory concepts of various advanced Metal forming processes.

Course Outcomes

- Analyze the various processes of forming used for given application.
- Illustrate various needs of metal forming processes and their comparison to other manufacturing processes.
- Analyze effect of parameters influencing metal forming and compare hot working and cold working with applications.
- Examine effects of friction & lubrication and causes of common defects in metal forming.
- Analyze various sheet metal and advanced metal forming processes.

Unit I

Fundamentals of Metal Forming: Classification of forming processes, mechanisms of metal forming: slab method, Upper and lower bound analysis, Deformation energy method and finite element method temperature of metal working, hot working, cold working, friction and lubricants.

Unit II

Rolling of metals: Rolling processes, forces and geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations.

Unit III

Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

Unit IV

Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes.

Drawing: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing.

Unit V

Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts. Advanced **Metal forming processes**: HERF, Electromagnetic forming, residual stresses, in process heat treatment and computer applications in metal forming. Problems on Blanking force, Blank diagram in Cup Diagram, Maximum considering shear.

Text Books

1. Mechanical Metallurgy by George E. Dieter, McGraw Hill Education.

2. Manufacturing Engineering and Technology, Kalpakjian, Pearson Publishers.

References Books

1. ASM Metal Forming Hand book.

2. Narayansamy, R., Metal Forming Technology, Ahuja Book Publishers, New Delhi (1995)

3. Principles of Metal Working processes / G.W. Rowe

4. Principles of Metal Working / Sunder Kumar

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MECHATRONICS

Course Code: GR18D5139 **L/T/P/C: 3/0/0/3**

Course objectives

- Have knowledge on mechatronic based systems and its importance.
- Impart knowledge on various types of sensors and transducers used in mechatronic systems to measure various physical parameter.
- Expose the student's knowledge with various actuating and controls systems to real time applications.
- Design PLC circuits, according to the required applications.
- Implement interfacing and data acquisition concepts on mechatronic products.

Course outcomes

- Develop an intelligent microprocessor based automated systems.
- Select appropriate sensors, transducers and actuators to monitor and control the behavior of a process or product.
- Apply design principles of electrical, mechanical, hydraulic and pneumatic systems to develop actuators and motion controllers.
- Develop PLC system and programs for a given task.
- Design and Interface data acquisition system for the required application.

Unit I

Mechatronics, Scope and Significance of Mechatronics systems, Elements of Mechatronic Systems, Needs and Benefits of Mechatronics in Manufacturing, Control Systems, Overview of Mechatronic Products, Microprocessor Based Controllers, Case Studies - Automatic Flush Tank, Car Engine Management System, Automated Washing Machine, Automated Camera.

Unit II

Sensors & Transducers: Sensor-Classification, Performance Terminology, Selection of Sensors, Sensors for Displacement, Force, Fluid Pressure, Liquid Flow, Light Sensors, Potentiometers, LVDT, Incremental and Absolute Encoders. Strain Gauges. Load cells, Temperature Sensors, Tachometers, Proximity &Tactile Sensors, Micro-Switch, Read Switch, and Vision Sensor.

Unit III

Actuating Systems: Hydraulic and Pneumatic systems, Components, Control Valves, Hydro-Pneumatic, Electro-Hydraulic Servo Systems: Mechanical Actuating Systems and Electrical Actuating Systems. Continuous and Discrete Process Controllers, Control Mode,

Proportional Mode, Derivative Mode, Integral Mode, PID Controllers, Velocity Control, Adaptive Control.

Unit IV

Programming Logic Controllers: Programmable Logic Controllers, Basic Structure, Input / Output Processing, Programming –Mnemonics, Timers, Internal relays and counters, Shift Registers, Master and Jump Controls Data Handling Analogs Input /Output Selection of a PLC.

Unit V

System Interfacing and Data Acquisition: Stages in Designing Mechatronics Systems, Traditional and Mechatronic Design, Data acquisition systems, SCADA, Analog to digital conversions and digital to analog conversions, interfacing with pick and place robot, Bar code system, Car park barrier system.

Text Books:

1. Bolton,W, "Mechatronics" , Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F, "Mechatronics integrated technologies for intelligent mach ines", Oxford university press, 2008

References Books

1. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007
2. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall,B 1993.
4. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPTIMIZATION TECHNIQUES

Course Code: GR18D5140 **L/T/P/C: 3/0/0/3**

Course objectives

- To have an understanding of research design and plot layout
- To analyze the data and interpret the results
- To create the factor and factorial design like single, multiple, full and fractional
- To understand the statistical terms like ANOVA, regression expected R square, F-test etc.
- To optimize the data using the techniques of RSM and Taguchi method

Course outcomes

- Understand the fundamentals of experiments and its uses.
- Analyze and apply the basic statistics including ANOVA and regression
- Design experiments such as Latin Square, factorial and fractional factorial designs
- Explain the application of statistical models in analyzing experimental data,
- Apply RSM and taguchi to optimize response of interest from an experiment

Unit I

Experimental Design Fundamental Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.

Unit II

Single Factor Experiments Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

Unit III

Multi factor Experiments Two and three factor full factorial experiments, 2K factorial Experiments, Confounding and blocking designs.

Unit IV

Special Experimental Designs Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F- tests.

Unit V

Taguchi Methods Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, case studies.

Text Books

1. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.

References Books

1. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
2. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS ANALYTICS

Course Code: GR18D5201 **L/T/P/C: 3/0/0/3**

Course Objectives

- Understand the role of business analytics and statistical tools used within an organization.
- Discuss Trendiness and Regression Analysis and different visualization techniques to explore data.
- Describe the organization structures and different type of business analytics.
- Know Forecasting Techniques, Monte Carlo Simulation and Risk Analysis.
- Understand decision analysis and recent trends in business intelligence.

Course outcomes

- Demonstrate business analytics process and use statistical tools for implementation of business process.
- Design relationships and trends to explore and visualize the data.
- Examine the organization structures of business analytics and Categorize types of analytics.
- Apply Forecasting Techniques, Monte Carlo Simulation and Risk Analysis.
- Formulate decision analysis and summarize recent trends in business intelligence.

Unit I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression, Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes, Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

Unit IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making, Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference Books

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G.
1. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDUSTRIAL SAFETY

Course Code: GR18D5202 **L/T/P/C: 3/0/0/3**

Course Objectives

- To understand the importance of maintaining a safe workplace.
- To maintain safety standards in compliance with regulatory requirements and within engineering limits understand personal safety and industrial safety.
- To create a job safety analysis (JSA) for a given work project.
- To follow safety recordkeeping and management, and the role of the safety manager.
- To utilize personal proactive equipment.

Course Outcomes

- Understanding of Safety principles.
- Analyze different types of exposure and biological effects, exposure guidelines and basic workplace monitoring Ability to do Hazard analysis.
- Demonstrate an understanding of workplace injury prevention, risk management, and incident investigations.
- Understand the acute and chronic health effects of exposures to chemical, physical and biological agents in the workplace.
- Demonstrate knowledge of the types of hazards, planning, organization and training needed to work safely with hazardous materials.

Unit I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors,
iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Reference Books

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATIONS RESEARCH

Course Code: GR18D5203 **L/T/P/C: 3/0/0/3**

Course Objectives

- To define and formulate linear and Non-linear programming problems and appreciate their limitations arising from a wide range of applications.
- To perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
- To distinguish various inventory models and develop proper inventory policies.
- To solve the scheduling and sequencing models.
- To understand how to model and solve problems using dynamic programming, Game Theory.

Course Outcomes

- The student will formulate and solve problems as networks and graphs for optimal allocation of limited resources such as machine, material and money.
- The student will able to carry out sensitivity analysis.
- The student will solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
- The student will able to distinguish various inventory models and develop proper inventory policies.
- The student will also propose the best strategy using decision making methods under uncertainty and game theory.

Unit I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex techniques, Sensitivity Analysis, Inventory Control Models

Unit II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Reference Books

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Panner selvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COST MANAGEMENT OF ENGINEERING PROJECTS

Course Code: GR18D5204 **L/T/P/C: 3/0/0/3**

Course Objectives

- To provide the student with a clear understanding of strategic cost management process.
- To describe the various stages of project execution.
- To prepare the project schedule by bar charts and network diagrams.
- To conduct breakeven and cost-volume-profit analysis.
- To make students understand various budgets and quantitative techniques used for cost management.

Course Outcomes

- The student will be able to explain the various cost concepts used in decision making.
- To be able to identify and demonstrate various stages of project execution.
- The student will be able to prepare the project schedule by bar charts and network diagrams.
- The student will be to differentiate absorption costing and marginal costing, also conduct breakeven and cost-volume-profit analysis.
- The student will be able to prepare various budgets and quantitative techniques used for cost management.

Unit I

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance.

Unit III

Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit IV

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

Unit V

Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Reference Books

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPOSITE MATERIALS

Course Code: GR18D5205 **L/T/P/C: 3/0/0/3**

Course Objectives

- To understand the concepts of fundamental science and engineering principles relevant to materials engineering.
- To expose the various methods to test mechanical properties on materials.
- To categorize the various equilibrium diagrams and describe the changes which occurs on metals.
- To explain the concepts on various heat treatment operations.
- To categorize the various ferrous and non-ferrous metals with their properties and applications.

Course Outcomes

- Relate crystal structures and identify the relation between different materials.
- Test the various mechanical properties of metal by suitable method.
- Relate the equilibrium transformation diagrams for various ferrous and Non- ferrous metals.
- Utilize appropriate techniques in treating a metal with proper heat treatment operations.
- Evaluate the behaviour of material when it is subjected to heat treatment process.

UNIT I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II

Reinforcement: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix, Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V

Strength, Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

WASTE TO ENERGY

Course Code: GR18D5206 **L/T/P/C: 3/0/0/3**

Course Objectives

- To find or recall the non-Hazardous secondary materials from waste.
- To compare precisely to overcome the cost and most economically attractive course of action for CH4 emission.
- To demonstrate the techno-economic feasibility of replacing.
- To extend the students for possible future activity in a biomass plant.
- To utilization in spark-ignited internal combustion engine.

Course outcomes

- Students are able to make use of energy installation and the small of household bio-waste incineration.
- To develop actual dimension must of course, fit requirement of the masonry block.
- To become capable of analyze and design of energy conversion system.
- Students are to estimate the possibility of invest in biomass generation.
- Students will be able to explain the biogas its uses and benefits.

Unit I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Reference Books

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH FOR RESEARCH PAPER WRITING

Course Code: GR18D5207 **L/T/P/C: 2/0/0/2**

Course objectives

- To state how to put research on paper.
- To demonstrate how to write an abstract.
- To apply the process of research.
- To appraise the key skills involved in writing the title, abstract, introduction and review of literature.
- To compose a paper that is good and has the qualities of acceptance and publication.

Course Outcomes

- Will be able to understand how to write a research paper.
- Will outline the drafting of an abstract.
- Will acquire the skills of various elements of research.
- Will be in a position to write a good paper.
- Will result in increasing the chance of publication.

Unit I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Unit III

Review of the Literature, Methods, Results, Discussion, Conclusions, TheFinal Check.

Unit IV

Key skills are needed when writing a Title, key skills are needed whenwriting an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit V

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusion.

Unit VI

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Reference Books

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Ian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISASTER MANAGEMENT

Course Code: GR18D5208 **L/T/P/C: 2/0/0/2**

Course objectives

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches.
- Planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes

- Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
- Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
- Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
- Capacity to manage the Public Health aspects of the disasters.
- Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

Unit I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit II

Repercussions of Disasters and Hazards: **Economic Damage**, Loss of Human and Animal Life, Destruction of Ecosystem. **Natural Disasters**: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit III

Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

Unit IV

Disaster Preparedness and Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit V

Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Unit VI

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Reference Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal bookCompany
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, NewDelhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., NewDelhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code: GR18D5209 **L/T/P/C: 2/0/0/2**

Course objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning of Sanskrit to improve brain functioning.
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects.
- Enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Outcomes

- Understanding basic Sanskrit alphabets and Understand tenses in Sanskrit Language.
- Enable students to understand roots of Sanskrit language.
- Students learn engineering fundamentals in Sanskrit.
- Students can attempt writing sentences in Sanskrit.
- Ancient Sanskrit literature about science & technology can be under stood.

Unit I

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Unit II

Order, Introduction of roots, Technical information about Sanskrit Literature

Unit III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Reference Books

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, NewDelhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New DelhiPublication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE EDUCATION

Course Code: GR18D5210 **L/T/P/C: 2/0/0/2**

Course objectives

- Understand value of education and self-development.
- Imbibe good values in students.
- Let they should know about the importance of character.
- To understand the significance of human conduct and self-development.
- To enable students to imbibe and internalize the value and Ethical behaviour in personal and professional lives.

Course outcomes

- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.
- Student will be able to realize the significance of ethical human conduct and self-development.
- Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.

Unit I

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgement.

Unit II

Importance of cultivation of values, Sense ofduty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline.

Unit III

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Unit IV

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Reference Books

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDIAN CONSTITUTION

Course Code: GR18D5211 **L/T/P/C: 2/0/0/2**

Course objectives

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional.
- Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
- To understand the role and functioning of Election Commission of India.

Course outcomes

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of1956.
- Discuss the significance of Election Commission of India.

Unit I

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working).

Unit II

Philosophy of the Indian Constitution: Preamble Salient Features.

Unit III

Contours of Constitutional Rights &Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit IV

Organs of Governance: Parliament-Composition, Qualifications and Disqualifications,

Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit V

Local Administration: District's Administration head, Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zilla Panchayat. Elected officials and their roles, CEO Zilla Panchayat, Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Unit VI

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Reference Books

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PEDAGOGY STUDIES

Course Code: GR18D5212 **L/T/P/C: 2/0/0/2**

Course objectives

- Review existing evidence on the review topic to inform programme design and policy making.
- Undertaken by the DFID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.
- Establishing coordination among people in order to execute pedagogy methods.
- To study pedagogy as a separate discipline.

Course Outcomes

- What pedagogical practices are being used by teachers in formal classrooms in developing countries?
- What pedagogical practices are being used by teachers in informal classrooms in developing countries?
- Synergy from the work force.
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

Unit II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit III

Evidence on the effectiveness of pedagogical practices, Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit IV

Professional development: alignment with classroom practices and follow- up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit V

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Reference Books

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRESS MANAGEMENT BY YOGA

Course Code: GR18D5213 **L/T/P/C: 2/0/0/2**

Course objectives

- To achieve overall Good Health of Body and Mind.
- To lower blood pressure and improve heart health.
- To become non-violent and truthfulness.
- To increase the levels of happiness.
- To eliminate all types of body pains.

Course outcomes

- Develop healthy mind in a healthy body thus improving social health also improve efficiently.
- Develop body awareness. Learn how to use their bodies in a healthy way. Perform well in sports and academics.
- Will balance, flexibility, and stamina, strengthen muscles and connective tissues enabling good posture.
- Manage stress through breathing, awareness, meditation and healthy movement.
- Build concentration, confidence and positive self-image.

Unit I

Definitions of Eight parts of yog. (Ashtanga)

Unit II

Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya andaparigraha Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit III

Asan and Pranayam, Various yoga poses and their benefits for mind & body. Regularization of breathing techniques and its effects-Types of pranayam

Reference Books

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal,Nagpur
2. "Rajayoga or conquering the Internal Nature" by SwamiVivekananda, Advaita Ashrama (Publication Department),Kolkata

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code: GR18D5214 **L/T/P/C: 2/0/0/2**

Course objectives

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom in students.
- To differentiate three types of happiness (Sukham).
- To describe the character traits of a spiritual devotee.

Course outcomes

- Study of Shrimad- Bhagwad-Gita wiil help the student in developing his personality and achieve the highest goal in life.
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity.
- To develop self-developing attitude towards work without self-aggrandizement.
- To develop tranquil attitude in all favorable and unfavorable situations.
- To develop high spiritual intelligence.

Unit I: Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride &heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Unit II: Approach to day to day work andduties.

- Shrimad Bhagwad Geeta : Chapter 2-Verses 41,47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23,35,
- Chapter 18-Verses 45, 46,48.

Unit III: Statements of basicknowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62,68
- Chapter 12 -Verses 13, 14, 15, 16,17,18
- Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses36,37,42,
- Chapter 4-Verses 18,38,39
- Chapter18 – Verses37,38,63

Reference Books

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department),Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, NewDelhi.