ACADEMIC REGULATIONS PROGRAMME STRUCTURE AND DETAILED SYLLABUS

Bachelor of Technology

Mechanical Engineering

(Effective for the students admitted from the Academic Year 2020-21)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

GOKARAJU RANGARAJU

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ACADEMIC REGULATIONS
PROGRAMME STRUCTURE
&
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Bachelor of Technology
Mechanical Engineering

(Four Year Regular Programme)
(Applicable for Batches Admitted from 2020-21)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Bachupally, Kukatpally, Hyderabad, Telangana, India- 500090

ACADEMIC REGULATIONS

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAMME BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

GR20 REGULATIONS

Gokaraju Rangaraju Institute of Engineering and Technology 2020 Regulations (GR20 Regulations) are given here under. These regulations govern the programmes offered by the Department of Mechanical Engineering with effect from the students admitted to the programmes in

2020- 21 academic year.

1. **Programme Offered:** The programme offered by the Department is B. Tech in Mechanical Engineering, a four-year regular programme.
2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.
3. **Admissions:** Admission to the B. Tech in Mechanical Engineering Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the Government/University or on the basis of any other order of merit approved by the Government/University, subject to reservations as prescribed by the Government/University from time to time.
4. **Programme Pattern:**

a) Each Academic year of study is divided in to two semesters.

b) Minimum number of instruction days in each semester is 90.

c) 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).

d) The total credits for the Programme is160.

e) Student is introduced to "Choice Based Credit System (CBCS)".

f) A student has a choice to register for all courses in a semester / one less or one additional course from other semesters provided the student satisfies prerequisites.

g) All the registered credits will be considered for the calculation of final CGPA.

h) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

i) **Subject / Course Classification:** All subjects/ courses offered for the under graduate programme in E & T (B.Tech. degree programmes) are broadly classified as follows

S. No.	Broad Course Classification	Course Group/ Category	CourseDescription
1	BS	Basic Science Courses	Basic Science Courses
2	ES	Engineering Science Courses	Includes Engineering subjects
3	HS	Humanities and Social sciences	Includes Management courses
4	PC	Professional Core Courses	Includes core subjects related to the parent discipline/department/ branch of Engineering
5	PE	Professional Elective Courses	Includes elective subjects related to the parent discipline/ department/ branch ofEngineering
6	OE	Open Elective Courses	Electives from other technicaland/or emerging subjects
7	LC	Laboratory Courses	Laboratory Courses
8	MC	Mandatory Courses	Environmental Sciences, Induction training, Indian Constitution, Essence ofIndian Traditional Knowledge
9	PW	Project Work	Project work, seminar and internship inindustry or elsewhere

5. Award of B.Tech Degree: A student will be declared eligible for the award B.Tech Degree if he/she fulfills the following academic requirements:

a) He/She pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.

b) A student has to register for all the 160 credits and secure all credits.

c) A student, who fails to fulfill all the academic requirements for the award of the degree within eight academic years from the date of admission, shall forfeit his/her seat in
B. Tech course.

d) The Degree of B. Tech in Computer Science and Engineering 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) Shortage of Attendance more than 10% (attendance less than 65% in aggregate) shall in no case becondoned.

e) 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 reregistration 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 from time to time.

b) Distribution and Weightage of marks

S. No	Components	Internal	External	Total
1	Theory	30	70	100
2	Practical	30	70	100
3	Engineering Graphics	30	70	100
4	Mini Project	30	70	100
5	Project Work	30	70	100

c) Continuous Internal Evaluation and Semester End Examinations: The assessment of the student's performance in each course will be based on Continuous Internal Evaluation (CIE) and Semester-End Examination (SEE). The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure:

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	30	Internal Examination & Continuous Evaluation	1) Two mid semester examination shall be conductedfor 20 markseach for a durationof 2 hours. Average ofthe two mid exams shall be considered **i) Subjective - 15marks** **ii) Objective - 5marks** **2) Tutorials - 5marks** **3) Continuous Assessment– 5 marks**
		70	Semester end examination	The semester-end examination isfor a duration of 3 hours
2	Practical	30	Internal Examination & Continuous Evaluation	**i) Internal Exam-10marks** **ii) Record - 5marks** **iii) ContinuousAssessment - 15 marks**
		70	Semester end examination	The semester-end examination isfor a duration of 3 hours

d) Mini Project with Seminar: 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. The supervisor continuously assesses the students for 20 marks (Continuous Assessment – 15 marks, Report – 5 marks). At the end of the semester, Mini Project shall be displayed in the road show at the department level for the benefit of all students and staff and the same is to be evaluated by Mini Project Review Committee for 10 marks. The mini project report shall be presented before Project Review Committee in the presence of External Examiner and the same is evaluated for 70 marks. Mini Project Review Committee consists of HOD, Mini Project Coordinator and Supervisor. Plagiarism check is compulsory for mini project report as per the plagiarism policy of GRIET.

e) Summer Internship: Summer Internship shall be done by the student in the summer break after III B. Tech II Semester and shall be evaluated in IV B. Tech I Semester along with the Project Work (Phase I).

f) Project Work (Phase–I and Phase-II): The project work is evaluated for 100 marks. Out of 100, 30 marks shall be for internal evaluation and 70 marks for the external evaluation. The supervisor assesses the student for 20 marks (Continuous Assessment – 15 marks, Report –5 marks). At the end of the semester, projects shall be displayed in the

road show at the department level for the benefit of all students and staff and the same is to be evaluated by the Project Review Committee for 10 marks. The external evaluation for Project Work is a Viva-Voce Examination which is conducted by the Project Review Committee in the presence of external examiner and is evaluated for 70 marks, Project Review Committee consists of HOD, Project Coordinator and Supervisor. These rules are applicable for both Phase I and PhaseII.
Plagiarism check is compulsory for project work report (Phase I and PhaseII) as per the plagiarism policy of GRIET.

g) Engineering Graphics:

- Two internal examinations, each is of 10 marks. The average of the two internal tests shall be considered for the award ofmarks.
- Submission of day to day work - 15marks.
- Continuous Assessment - 5marks.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for recounting 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 to secure the required creditscan appearfor a supplementary examination, as per the schedule announced by the College.

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 and Promotion Rules:**

a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or laboratories if he/she secures not less than 35% of marks in the Semester-end Examination and a minimum of 40% of the sum totalof the Internal Evaluation and Semester-end Examination taken together.

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

	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to second year first semester	(i) Regular course of study of first year secondsemester. (ii) Must have secured at least 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether thestudent takes those examinations or not.
3	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to third year first semester	(i) Regular course of study of secondyear secondsemester (ii) Must have secured at least 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether thestudent takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	(i) Regular course of study of third yearsecond semester. (ii) Must have secured at least 60% credits up to third year second semester fromall the relevant regular and supplementary examinations, whether the student takes those examinations ornot.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

13. Grade Points: A 10 - point grading system with corresponding letter gradesandpercentage of marks, as given below, is followed

Letter Grade	Grade Point	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 (Average)	6	Marks >= 50 and Marks < 60
C (Pass)	5	Marks >= 40 and Marks < 50
F (Fail)	0	Marks < 40
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-P. 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 8) 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 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.

14. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B. Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the160 credits.

	Class Awarded	CGPA Secured
14.1	First Class With Distinction	CGPA >= 8.00 with no F or below grade/ detention anytime during the programme
14.2	First Class	CGPA >= 8.00 with rest of the clauses of 14.1 not satisfied
14.3	First Class	CGPA ≥ 6.50 and CGPA < 8.00
14.4	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
14.5	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

15. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against the student, the result of the student (for that Semester) may be with held and the student will not be allowed to go into the next semester. The award or issue of the Degree may also be withheld in such cases.
16. **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.
17. **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/re-registration to the same or equivalent subjects as and when they are offered.

18. 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.

Academic Regulations for B.Tech (Lateral Entry) under GR20 (Applicable for Batches Admitted from 2021-2022)

1. **All regulations as applicable for B.Tech Four year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme) except for the following rules**
   - **a)** Pursued programme of study for not less than three academic years and not more than six academic years.
   - **b)** A student should register for all 120 credits and secure all credits. The marks obtained in all 120 credits shall be considered for the calculation of the final CGPA.
   - **c)** Students who fail to fulfil all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech programme.

2. **Academic Requirements and Promotion Rules:**

   - **a)** A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or laboratories if he/she secures not less than 35% of marks in the Semester-end Examination and a minimum of 40% of the sum total of the Internal Evaluation and Semester-end Examination taken together.
   - **b)** A student shall be promoted to the next year only when he/she satisfies the requirements of all the previous semesters.

S. No.	Promotion	Conditions to be fulfilled
1	**Second year first semester to second year second semester.**	**Regular course of study of second year first semester.**
2	**Second year second semester to third year first semester.**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 50% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations ornot.**
3	**Third year first semester to third year second semester.**	**Regular course of study of third year first semester.**
4	**Third year second semester to fourth year first semester.**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**

5	**Fourth year first semester to fourth year second semester.**	**Regular course of study of fourth year first semester.**

3. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B. Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the 120 credits.

	Class Awarded	CGPA Secured
3.1	**First Class With Distinction**	**CGPA >= 8.00 with no F or below grade/ detention anytime during the Programme**
3.2	**First Class**	**CGPA >= 8.00 with rest of the clauses of 3.1 not satisfied**
3.3	**First Class**	**CGPA ≥ 6.50 and CGPA < 8.00**
3.4	**Second Class**	**CGPA ≥ 5.50 and CGPA < 6.50**
3.5	**Pass Class**	**CGPA ≥ 5.00 and CGPA < 5.50**

Academic Regulations for B.Tech. with Minors Programme under GR20
(Applicable for Batches Admitted from 2020-21)

1. Objectives

The key objectives of offering B. Tech. with Minor program are:

- To expand the domain knowledge of the students in one of the other programmes of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in interdisciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own programme of study.
- To offer the knowledge in the areas which are identified as emerging technologies/thrust areas of Engineering.

2. Academic Regulations for B.Tech. Degree with Minor programmes

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4 -Years B.Tech. programme.

b) For B.Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech. degree). All these 18 credits need to be completed in III year and IV year only.

c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., he/she will be awarded only B.Tech. degree in the concerned programme.

d) There is no transfer of credits from Minor programme courses to regular B.Tech. degree course and vice versa.

e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCS platform.

f) For the course selected under MOOCS platform following guidelines may be followed:

- **i)** Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
- **ii)** Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.
- **iii)** Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.
- **iv)** Any expenses incurred for the MOOCS courses are to be met by the students only.

g) The option to take a Minor programme is purely the choice of the student.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor programme at any time; and in that case the student will be awarded only B.Tech. degree in the concerned programme on earning the required credits of 160.

i) The student can choose only one Minor programme along with his/her basic engineering degree. A student who chooses an Honors programme is not eligible to choose a Minor programme and vice-versa.

j) A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B.Tech. programme as well as fulfils the requirements for Minor programme.

k) The institute shall maintain a record of students registered and pursuing their Minor programmes, minor programme-wise and parent programme -wise. The same report needs to be sent to the University once the enrolment process is complete.

l) The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

3. Eligibility conditions for the student to register for Minor programme

a) A student can opt for B.Tech. programme with Minor programme if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor programme, before commencement of III year I Semester (V Semester), is mandatory

c) If more than 50% of the students in a programme fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

4. Registration for the courses in Minor Programme

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. Minor courses and the offering departments

S. No.	Minor Programme	Eligible programme of students	@Offering Department	Award of Degree
1.	Artificial Intelligence & Machine Learning	All programmes, except B.Tech. in CSE (AI&ML) /B.Tech. (AI&ML)/ B.Tech. (AI)/ B.Tech. CSE(AI)	CSE	"B.Tech. in programme name with Minor in Artificial Intelligence & Machine Learning"

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MECHANICAL ENGINERING
B. Tech (ME) – GR20 Course Structure

I B. Tech (ME) - I Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR20A1001	Linear Algebra and Differential Calculus	3	1	0	4	3	1	0	4	30	70	100
2	Physics	BS	GR20A1004	EngineeringPhysics	3	1	0	4	3	1	0	4	30	70	100
3	English	HS	GR20A1006	English	2	0	0	2	2	0	0	2	30	70	100
4	CSE	ES	GR20A1007	Programming forProblem Solving	2	1	0	3	2	1	0	3	30	70	100
5	ME	ES	GR20A1010	Engineeringraphics	1	0	2	3	1	0	4	5	30	70	100
6	Physics	BS	GR20A1013	EngineeringPhysics L a b	0	0	1.5	1.5	0	0	3	3	30	70	100
7	CSE	ES	GR20A1016	Programming for Problem SolvingLab	0	0	1.5	1.5	0	0	3	3	30	70	100
8	English	HS	GR20A1015	English Language and CommunicationSkills Lab	0	0	1	1	0	0	2	2	30	70	100
TOTAL					**11**	**3**	**6**	**20**	**11**	**3**	**12**	**26**	**240**	**560**	**800**
9	Mgmt	MC	GR20A1021	Life skills andPersonality Development	1	**0**	0	1	**2**	**0**	0	2	30	70	100

I B. Tech (ME) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR20A1002	Differential Equations and Vector Calculus	3	1	0	4	3	1	0	4	30	70	100
2	Chemistry	BS	GR20A1005	EngineeringChemistry	3	1	0	4	3	1	0	4	30	70	100
3	ME	ES	GR20A1009	EngineeringMechanics	3	1	0	4	3	1	0	4	30	70	100
4	CSE	ES	GR20A1011	Data Structures	2	1	0	3	2	1	0	3	30	70	100
5	Chemistry	BS	GR20A1014	Engineering Chemistry Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
6	CSE	ES	GR20A1018	Data StructuresLab	0	0	1	1	0	0	2	2	30	70	100
7	ME	ES	GR20A1019	EngineeringWorkshop	1	0	1.5	2.5	1	0	3	4	30	70	100
TOTAL					**12**	**4**	**4**	**20**	**12**	**4**	**08**	**24**	**210**	**490**	**700**
8	Mgmt	MC	GR20A1020	Design Thinking	1	0	0	1	2	0	0	2	30	70	100

II B.Tech- I Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext.	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ME	PC	GR20A2038	Kinematics of Machinery	3	0	0	3	3	0	0	3	30	70	100
2	ME	PC	GR20A2039	Materials Engineering	2	1	0	3	2	1	0	3	30	70	100
3	EEE	ES	GR20A2017	Basic Electricaland Electronics Engineering	3	0	0	3	3	0	0	3	30	70	100
4	ME	PC	GR20A2040	Strength ofMaterials	3	0	0	3	3	0	0	3	30	70	100
5	ME	PC	GR20A2041	Thermodynamics	3	0	0	3	3	0	0	3	30	70	100
6	ME	PC	GR20A2042	Machine and Production Drawing Lab	0	0	2	2	0	0	4	4	30	70	100
7	ME	PC	GR20A2043	Strength of Materials Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
8	ME	PC	GR20A2044	Materials Science and Metallurgy Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
TOTAL					**14**	**1**	**5**	**20**	**14**	**1**	**10**	**25**	**240**	**560**	**800**
9	IT	MC	GR20A2007	Java for Engineers	2	0	0	2	2	0	0	2	30	70	100

II B.Tech- II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext.	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ME	PC	GR20A2045	Thermal Engineering	3	0	0	3	3	0	0	3	30	70	100
2	ME	PC	GR20A2046	Fluid Mechanics and FluidMachines	3	0	0	3	3	0	0	3	30	70	100
3	ME	PC	GR20A2047	Dynamics ofMachinery	3	0	0	3	3	0	0	3	30	70	100
4	Maths	BS	GR20A2005	Probability andStatistics	3	0	0	3	3	0	0	3	30	70	100
5	ME	PC	GR20A2048	ManufacturingProcess	2	1	0	3	2	1	0	3	30	70	100
6	ME	PC	GR20A2049	Thermal Engineering Lab	0	0	2	2	0	0	4	4	30	70	100
7	ME	PC	GR20A2050	ManufacturingProcess Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
8	ME	PC	GR20A2051	Fluid Mechanics and Fluid Machines Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
TOTAL					**14**	**1**	**5**	**20**	**14**	**1**	**10**	**25**	**240**	**560**	**800**
9	Mgmt	MC	GR20A2003	Constitution ofIndia	2	0	0	2	2	0	0	2	30	70	100
10	CSE	MC	GR20A2006	Data Base forEngineers	2	0	0	2	2	0	0	2	30	70	100

III Year I Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ME	PC	GR20A3023	Machine Design	2	1	0	3	2	1	0	3	30	70	100
2	Mgmt	HS	GR20A2004	Economics and Accounting for Engineers	3	0	0	3	3	0	0	3	30	70	100
3	ME	PC	GR20A3024	Manufacturing Technology	3	0	0	3	3	0	0	3	30	70	100
4	ME	PC	GR20A3025	Applied Thermodynamics	2	0	0	2	3	0	0	3	30	70	100
5	ME	PE-I		Professional Elective-I	3	0	0	3	3	0	0	3	30	70	100
6	ME	OE-I		Open Elective-I	3	0	0	3	3	0	0	3	30	70	100
7	ME	PC	GR20A3031	Manufacturing Technology Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
8	ME	PC	GR20A3032	Metrology Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
TOTAL					**16**	**1**	**3**	**20**	**17**	**1**	**6**	**24**	**240**	**560**	**800**

PROFESSIONAL ELECTIVE – I				
S. No.	BOS	Group	Course Code	Course
1	ME	PE	GR20A3026	Metrology and Surface Engineering
2	ME	PE	GR20A3027	Solid Mechanics
3	ME	PE	GR20A3028	Automobile Engineering
4	ME	PE	GR20A3029	Intelligent Manufacturing Systems

Open Elective –I			
S.No	**BOS**	**Course Code**	**Course Name**
1	MECH	GR20A3030	Robotics

III B.Tech-II Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ME	PC	GR20A3098	Design of Machine Elements	3	0	0	3	3	0	0	3	30	70	100
2	ME	PC	GR20A3099	Heat Transfer	2	1	0	3	2	1	0	3	30	70	100
3	Mgmt	HS	GR20A3140	Fundamentals of Management and Entrepreneurship	3	0	0	3	3	0	0	3	30	70	100
4	ME	PE-II		Professional Elective-II	3	0	0	3	3	0	0	3	30	70	100
5	ME	OE-II		Open Elective-II	3	0	0	3	3	0	0	3	30	70	100
6	ME	PC	GR20A3105	Computer Aided Modeling and 3D Printing Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
7	ME	PC	GR20A3106	Heat Transfer Lab	0	0	1.5	1.5	0	0	3	3	30	70	100
8	ME	PW	GR20A3141	Mini Project with Seminar	0	0	2	2	0	0	4	4	30	70	100
TOTAL					**14**	**1**	**5**	**20**	**14**	**1**	**10**	**25**	**240**	**560**	**800**
9	Mgmt	MC	GR20A2002	Value Ethics and Gender Culture	2	0	0	2	2	0	0	2	30	70	100

PROFESSIONAL ELECTIVE – II				
S. No.	BOS	Group	Course Code	Course
1	ME	PE	GR20A3100	Design for Manufacturing
2	ME	PE	GR20A3101	Computational Fluid Dynamics
3	ME	PE	GR20A3102	Un-Conventional Energy Sources
4	ME	PE	GR20A3103	Microprocessors in Automation

Open Elective –II			
S.No	BOS	Course Code	Course Name
1	MECH	GR20A3104	Composite Materials

IV B.Tech I Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext.	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ME	PC	GR20A4025	CAD/CAM	3	0	0	3	3	0	0	3	30	70	100
2	ME	PC	GR20A4026	Instrumentationand Control Systems	3	0	0	3	3	0	0	3	30	70	100
3	ME	PE-III		Professional Elective-III	3	0	0	3	3	0	0	3	30	70	100
4	ME	PE-IV		Professional Elective-IV	3	0	0	3	3	0	0	3	30	70	100
5	ME	OE-III		Open Elective-III	3	0	0	3	3	0	0	3	30	70	100
6	ME	PC	GR20A4034	Instrumentationand Control Systems Lab	0	0	2	2	0	0	4	4	30	70	100
7	ME	PC	GR20A4035	Computer Aided Analysis and Manufacturing Lab	0	0	2	2	0	0	4	4	30	70	100
8	ME	PW	GR20A4129	Project Work-Phase I	0	0	6	6	0	0	12	12	30	70	100
TOTAL					**15**	**0**	**10**	**25**	**15**	**0**	**20**	**35**	**240**	**560**	**800**
9	Chemistry	MC	GR20A2001	Environmental Science	2	0	0	2	2	0	0	2	30	70	100

PROFESSIONAL ELECTIVE – III				
S. No.	BOS	Group	Course Code	Course
1	ME	PE	GR20A4027	Flexible Manufacturing Systems
2	ME	PE	GR20A4028	Tribology
3	ME	PE	GR20A4029	Finite Element Analysis
4	CSE	PE	GR20A3063	Internet of Things

PROFESSIONAL ELECTIVE – IV				
S. No.	BOS	Group	Course Code	Course
1	ME	PE	GR20A4030	Automation in Manufacturing
2	CSE	PE	GR20A3046	Artificial Intelligence
3	ME	PE	GR20A4031	Refrigeration and Air-Conditioning
4	ME	PE	GR20A4032	Mechatronic Systems

Open Elective –III			
S.No	BOS	Course Code	Course Name
1	MECH	GR20A4033	Operations Research

IV B.Tech-II Semester

S.No	BOS	Group	CourseCode	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ME	PC	GR20A4100	Rapid Prototypingand Tooling	3	0	0	3	3	0	0	3	30	70	100
2	ME	PE-V		ProfessionalElective-V	3	0	0	3	3	0	0	3	30	70	100
3	ME	PE-VI		ProfessionalElective-VI	3	0	0	3	3	0	0	3	30	70	100
4	ME	PW	GR20A4130	Project Work-Phase II	0	0	6	6	0	0	12	12	30	70	100
TOTAL					9	0	6	**15**	**9**	**0**	**12**	**21**	**120**	**280**	**400**

PROFESSIONAL ELECTIVE – V				
S. No.	BOS	Group	Course Code	Course
1	ME	PE	GR20A4101	Sustainable Manufacturing
2	CSE	PE	GR20A3067	Augmented Reality and Virtual Reality
3	ME	PE	GR20A4102	Gas Dynamics and Jet Propulsions
4	ME	PE	GR20A4103	Un-Conventional Machining Processes

PROFESSIONAL ELECTIVE – VI				
S. No.	BOS	Group	Course Code	Course
1	ME	PE	GR20A4104	Production Planning and Control
2	ME	PE	GR20A4105	Mechanical Vibrations
3	ME	PE	GR20A4106	Power Plant Engineering
4	CSE	PE	GR20A3135	Block Chain Technology

PROFESSIONAL ELECTIVES			
MANUFACTURING	**DESIGN**	**THERMAL**	**AUTOMATION**
Metrology and Surface Engineering	Solid Mechanics	Automobile Engineering	Intelligent Manufacturing Systems
Design for Manufacturing	Computational Fluid Dynamics	Un-Conventional Energy Sources	Microprocessors in Automation
Flexible Manufacturing Systems	Tribology	Finite Element Analysis	Internet of Things
Automation in Manufacturing	Artificial Intelligence	Refrigeration and Air-Conditioning	Mechatronic Systems
Sustainable Manufacturing	Augmented Reality and Virtual Reality	Gas Dynamics and Jet Propulsions	Un-Conventional Machining Processes
Production Planning and Control	Mechanical Vibrations	Power Plant Engineering	Block Chain Technology

THREAD 1	THREAD 2	OFFERED BY
1. Soft Skills and Interpersonal Communication 2. Human Resource Development and Organizational Behavior 3. Cyber Law and Ethics 4. Economic Policies in India	1. Principles of E-Commerce	**CSE**
	2. Business Analytics	
	3. Augmented Reality and Virtual Reality	
	1. Internet of Things	**CSE (AIML)**
	2. Augmented Reality and Virtual Reality	
	3. Distributed Database and Systems	
	1. Augmented Reality and Virtual Reality	**CSE (DS)**
	2. Internet of Things	
	3. Human Computer Interaction	
	1. Services Science and Service Operational Management 2. IT Project Management 3. Marketing Research and Marketing Management	**CSBS**
	1. Artificial Intelligence	**IT**
	2. Introduction to Data Science	
	3. Human Computer Interaction	
	1. Non-Conventional Energy Sources	**EEE**
	2. Machine Learning	
	3. Artificial Intelligence Techniques	
	1. Principles of Communication	**ECE**
	2. Sensor Technology	
	3. Cellular and Mobile Communications	
	1. Robotics	**ME**
	2. Composite Materials	
	3. Operations Research	
	1. Engineering Materials for Sustainability	**CE**
	2. Geographic Information Systems and Science	
	3. Environmental Impact Assessment and Life CycleAnalyses	

I YEAR

I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGYLINEAR ALGEBRA AND DIFFERENTIAL CALCULUS

Course Code: GR20A1001 **L/T/P/C: 3/1/0/4**
I Year I Semester

Course Objectives:

1. Apply ideas to solve linear systems, at the core of many engineering concepts.
2. Apply concept of latent values of a matrix which is critical in many engineeringapplications.
3. Take part in, function approximation using the tools of mean value theorems.
4. Compose optimal values of multi-variable functions.
5. Utilize definite integral concept for various geometrical applications.

Course Outcomes:

1. Compile the rank of a matrix to determine the existence of solutions of a linear algebraic system
2. Determine the eigenvalues and eigenvectors of a square matrix which arise in several engineering applications
3. Determine approximate solution of over determined systems using the pseudo inverse.
4. Develop the skill of determining optimal values of multivariable functions using classical methods.
5. Apply the definite integral concept for various computational problems in geometry.

UNIT I
VECTOR AND MATRIX ALGEBRA

Vector space (definition and examples), linear independence of vectors, orthogonality of vectors, projection of vectors Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices; Rank of a matrix by echelon reduction, Solution of a linear algebraic system of equations (homogeneous and non-homogeneous)

UNIT II
MATRIX EIGENVALUE PROBLEM AND QUADRATIC FORMS

Determination of eigen values and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof), diagonalization of a matrix, orthogonal diagonalization of symmetric matrices, Similarity of matrices

Quadratic Forms: Definiteness and nature of a quadratic form, reduction of quadratic form to canonical form by orthogonal transformation

UNIT III
MATRIX DECOMPOSITION AND PSEUDO INVERSE OF A MATRIX

Spectral decomposition of a symmetric matrix, L-U decomposition,Gram-Schmidt orthonormalization of vectors, Q-R factorization, Singular value decomposition Moore-Penrose pseudo inverse of a matrix, least squares solution of an over determined system of equations using pseudo inverse

UNIT IV
MULTIVARIABLE DIFFERENTIAL CALCULUS AND FUNCTION OPTIMIZATION:

Partial Differentiation: Total derivative. Jacobian; Functional dependence Unconstrained optimization of functions using the Hessian matrix, constrained optimization using Lagrange multiplier method

UNIT V

SINGLE VARIABLE CALCULUS

Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem and Taylor's theorem (without proof), their geometrical interpretation, approximation of a function by Taylor's series Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves(for Cartesian coordinates)

TEXTBOOKS

1. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa publishinghouse, Fourth edition 2014
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thedition,Pearson,Reprint.

REFERENCES:

1. GRIET reference manual
2. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING PHYSICS

Course Code: GR20A1004 **L/T/P/C: 3/1/0/4**
I Year I Semester

Course Objectives:

1. Understand interaction of light with matter through interference and diffraction phenomena.
2. Discuss the use of lasers as light sources in optical fiber applications.
3. Outline the behavior of free electrons in materials.
4. Study the properties and fabrication methods of nanomaterials.
5. Recognize the basic concepts of Acoustics and ultrasonic.

Course Outcomes:

1. Apply the principles of interference and diffraction of light in engineering applications.
2. Analyze the properties of Laser and its propagation in different types of optical fibers.
3. Classify materials based on the theory of Kronig Penny model.
4. Understand the nature and characterization of nanomaterials and its applications.
5. Comprehend the concepts of Acoustics and Non-destructive testing in solving engineering problems.

UNIT I

Wave Optics: Superposition of waves and interference of light by wave front splitting and amplitude splitting, Young's double slit experiment, Interference in thin films by reflection, Newton's rings, Difference between interference and diffraction, Fraunhofer diffraction from a single slit, Diffraction grating, Grating spectrum and resolving power, Determination of wavelength of light using diffraction grating.

UNIT II

Lasers: Interaction of radiation with matter: Absorption, Spontaneous emission and Stimulated emission, Characteristics of lasers, Einstein coefficients, Resonating cavity, Active medium-Meta stable state, Pumping, Population inversion, Construction and working of Ruby laser and He-Ne laser, Applications of lasers.

Fiber Optics: Introduction, Principle and Structure of an optical fiber, Basic components in optical fiber communication system, Comparison of optical fibers over conventional cables, Acceptance angle-Numerical aperture, Types of fibers, Losses associated with optical fibers, Applications of optical fibers.

UNIT III

Introduction to solids: Fermi Energy level, Fermi distribution function, Bloch's theorem, Kronig – Penny model (Qualitative), E-K diagram, Brillouin Zones, Effective mass of electron, Origin of energy bands, Classification of materials on the basis of energy bands, Intrinsic and extrinsic semiconductors (Qualitative), Direct and Indirect band gap semiconductors.

UNIT IV

Engineered semiconductor materials: Nanomaterials, Introduction, Quantum confinement, Surface to volume ratio, Classification of nanomaterials as 0D, 1D, 2D and 3D (qualitative), Examples of low-dimensional systems such as quantum wells, wires and dots, Fabrication: Top-Down technique by CVD method, Bottom–Up technique by Sol-Gel method, Characterization techniques: SEM, TEM and EDAX.

UNIT V

Acoustics: Basic requirements of acoustically good hall, Reverberation and Reverberation time, Sabine's formula for Reverberation time (Qualitative), Measurement of absorption coefficient of a material, Factors affecting the architectural acoustics and their remedies.

Ultrasonic: Introduction, Classification of ultrasonic waves: Longitudinal waves, Transverse waves, Surface waves and Plate waves, Production of ultrasonic waves: Piezoelectric method and Magnetostriction method, Properties of ultrasonic waves, Applications of ultrasonic: SONAR and NDT (Pulse echo method).

Teaching methodologies:

- White board and marker
- Power Point Presentations
- Video lectures

Text Books:

1. Engineering Mechanics, 2nd ed.- MK Harbola, Cengage Learning
2. Mechanics, D S Mathur and P S Hemne, S Chand
3. I. G. Main, "Vibrations and waves in physics', 3rd Edn, Cambridge University Press, 2018
4. Applied Physics, T. Bhīma Sankaram, BSP Publishers.
5. Engineering Physics, P.K Palanisamy, Scitech Publishers.
6. AjoyGhatak, "Optics", McGraw Hill Education, 2012

References:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006
2. O. Svelto, "Principles of Lasers"
3. "Introduction to Mechanics", M.K.Verma, Universities Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH

Course Code: GR20A1006 **L/T/P/C: 2/0/0/2**

I Year I Semester

Course Objectives:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
3. Develop study skills and communication skills in formal and informal situations.
4. Understand the importance of defining, classifying and practice the unique qualities of professional writing style.
5. Employ the acquired knowledge in classroom with reference to various social and professional spheres thus leading to a life-long learning process

Course Outcomes:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view

UNIT I

Where the Mind is without Fear poem by Rabindranath Tagore

Vocabulary Building: The Concept of Word Formation-- The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading
Basic Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation- Techniques for writing precisely – Paragraph writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT II

The Last Leaf by O. Henry Vocabulary: Synonyms and Antonyms.
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Note Making, PrécisWriting, Writing an Abstract, Nature and Style of Sensible Writing-
Defining- Describing Objects, Places and Events – **Classifying**- Providing Examples or Evidence

UNIT III

'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary:Acquaintance with Prefixes and Suffixes from Foreign Languages in English toform Derivatives-Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers-Verbs and Tenses.

Reading: Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-Writing Formal LettersE.g. Letter of Complaint,Letter of Requisition, Use of phrases for formal and informal letter writing.

UNIT IV
'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Standard Abbreviations in English and Phrasal Verbs **Grammar:** Redundancies and Clichés in Oral and Written Communication.**Reading**: Comprehension**-** Intensive Reading and Extensive Reading
Writing: Writing Introduction and Conclusion -Essay Writing-Types of Essays- Picture Composition

UNIT V
'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press. Vocabulary: Technical Vocabulary and their usage
Vocabulary: One Word Substitutes, Technical vocabulary and their usage
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice
Writing:Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Text Books:

1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.

References:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P. (2018). Communication Skills. Oxford University Press.
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006). Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING

Course Code: GR20A1007 **L/T/P/C: 2/1/0/3**
I Year I Semester

Course Objectives:

1. To interpret the various steps in program development.
2. To recall and recite the fundamentals, syntax and semantics of C programming language.
3. To illustrate problem solving using arrays, strings, structures and pointers.
4. To demonstrate using of structured and modular programming approach in solvingproblems.
5. To code, Interpret and debug the given program using files.

Course Outcomes:

1. To write algorithms and to draw flowcharts and remember and reuse the fundamentals of Clanguage.
2. To apply decision making statements and arrays to solve problems.
3. To illustrate the need for strings and functions in problem solving.
4. To implement pointers and structures in writing programs.
5. To illustrate working with files and preprocessor directives in c.

UNIT I

Introduction to Programming: Introduction to Algorithms: Representation of Algorithm, Flowchart, Pseudo code with examples, Compiling &executing program, Syntax and logical errors.

Introduction to C Programming Language: Structure of c program,Variables, Data types, Constants,Operators, Expressions and precedence, Expression evaluation,Type conversion.

I/O: Simple input and output with formatted I/O and unformatted I/O.

UNIT II

Decision Making and Arrays: Conditional Branching and Loops: Conditional branching with if, if-else, nestedifelse, else if ladder, switch-case, Loops: for, while, do-while, Jumping statements: goto, break,continue.

Arrays: One and Two dimensional arrays, creating, Accessing and manipulating elements of arrays

Searching: Basic searching in an array of elements, Linear and Binary search.

UNIT III

Strings and Functions: Strings: Introduction to strings, Operations on characters, Basic string functions available in C (strlen, strcat, strcpy, strrev,strcmp), String operations without string handling functions, Arrays of strings.

Functions: Designing structured programs, declaring a function, Signature of a function, Parameters and return type of a function(categories of functions), call by value,call by reference, passing arrays to functions, recursion, merits and demerits of recursive functions, Storage classes.

UNIT IV

Pointers and Structures: Pointers: Idea of pointers, Defining pointers, Pointer to pointer, void pointer, Null pointer, Pointers to Arrays and Structures, Function pointer. **Structures and unions:**

Defining structures, Initializing Structures, Array of structures, Arrays within structures, Nested structures, Passing structures to functions, Unions, typedef.

UNIT V

File handling and Preprocessor in C:

Files: Text and Binary files, Creating and Reading and writing text and binary files, Random access to files, Error Handling in files, Command line arguments, Enumeration data type.

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef,elif.

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning,(3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING GRAPHICS

Course Code: GR20A1010 **L/T/P/C: 1/0/4/3**
I Year I Semester

Course Objectives:

1. Provide basic conventions and standards used in Engineering Graphics.
2. Impart knowledge on various Engineering curves and their significance.
3. To draw orthographic, sectional and pictorial views of a given solid.
4. To develop skills in three dimensional visualization of engineering components.
5. To inculcate CAD packages on modelling and drafting.

Course Outcomes:

1. Familiarize with BIS standards and conventions used in engineering graphics.
2. Draw various engineering curves e.g., ellipse, parabola, cycloids and involutes etc and construct various reduced scales e.g., plain, diagonal and Vernier scales.
3. Differentiate between first angle and third angle methods of projection and distinguish parallel and perspective projection.
4. Visualize different views like elevation and plan for a given line, plane figures or solid objects.
5. Apply drafting techniques and use 2D software e.g., AutoCAD to sketch 2D plane figures.

UNIT I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance; **Conic Sections-** ellipse, parabola and hyperbola – General method only. **Cycloidal curves** –cycloid**,** epi-cycloid and hypo-cycloid; **Scales**– plain and diagonal.

UNIT II

Projections of Points, Lines and Planes: Introduction to principal planes of projections, **Projections of the points** located in same quadrant and different quadrants, **Projections of line** with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes. **Projections of regular planes** (polygons, circle and Square etc.,) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane.

UNIT III

Projections of solids (regular and right solids only) - Classification of solids, Projections of solids (Cylinder, Cone, Pyramid and Prism) **Intersection of solids** – concept of lines of intersection and curves of intersection, intersection of solids (Prism Vs Prism and Cylinder Vs Cylinder) with their axes perpendicular to each other.

UNIT IV

Section of solids – Sectional views of solids (Cylinder, Cone, Pyramid and Prism) and the true shape of the section, **Development of surfaces-** Development of surfaces of solids (Cylinder, Cone,Pyramid and Prism).

UNIT V

Orthographic Projections: Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method;

Isometric Projections and Isometric View: Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts, Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions

Introduction to CAD: (For Internal Evaluation Weightage only): Introduction to CAD Software Package Commands.- Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package

Text /Reference Books:

1. Engineering Drawing by N.D.BHATT/CHAROTAR PUBLISHING HOUSE PVT LTD
2. Engineering Drawing by Basanth Agrawal/ C M Agrawal/ McGraw Hill Education
3. Engineering Drawing by K.Venu Gopal/New Age Publications.
4. Engineering Graphics Essentials with AutoCAD 2018 Instruction by Kirstie Platenberg/SDC publications.
5. Computer Aided Engineering Drawing / K Balaveerareddy et al-CBS publishers
6. Engineering Graphics and Design by Kaushik Kumar / Apurbakumar Roy / Chikesh

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING PHYSICS LAB

Course Code: GR20A1013 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

Course Objectives:

1. Experiment with resonance phenomena using mechanical and electrical sources.
2. Analyze the mechanical properties of solid materials.
3. Recall the basic properties of light through hands on experience.
4. Apply the theoretical concepts of Lasers and optical fibers in practical applications.
5. Outline the characteristics of various semiconducting materials.

Course Outcomes:

1. Evaluate the frequency of tuning fork, spring constant through coupled oscillation and analyze the resonance phenomena in LCR circuit.
2. Compare the rigidity modulus of wires of different materials using Torsional pendulum.
3. Interpret the properties of light like interference and diffraction through experimentation.
4. Asses the characteristics of Lasers and infer the losses in optical fibers.
5. Identify the type of semiconductor by measuring energy gap.

LIST OF EXPERIMENTS:

1. Melde's experiment: To determine the frequency of a turning fork usingMelde's arrangement.
2. Torsional pendulum: To determine the rigidity modulus of the given wire using Torsional pendulum.
3. Newton's rings: To determine the radius of curvature of the lens by forming Newton's rings.
4. Diffraction grating: To determine the wavelength of the light source by using diffraction grating.
5. Dispersive power: To determine the dispersive power of prism by using spectrometer.
6. Coupled Oscillator: To determine the spring constant by single coupled oscillator.
7. LCR Circuit: To determine the resonant frequency and quality factor of LCR circuit in series and parallel.
8. LASER: To study the V-I and P-I characteristics of LASER sources.
9. Optical fiber: To determine the Numerical aperture and bending losses of Optical fibers.
10. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.

Note: Any 8 experiments are to be performed.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: GR20A1016 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

Course Objectives:

1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. To write programs to create, read from and write to text and binary files.

Course Outcomes:

1. Formulate the algorithms for simple problems and translate algorithms to a working and correct program.
2. Identify, analyse and correct syntax and logical errors encountered during coding.
3. Interpret and implement programs using branching and looping statements.
4. Represent and manipulate data with arrays, strings and structures and use pointers.
5. Create, read and write to and from simple text and binary files and modularize the code with functions so that they can be reused.

TASK 1

a. Write a C program to implement operators in c?
b. Write a C program to find greatest and smallest among three numbers using conditional operator.
c. Write a C program to implicit and explicit type conversion in c?

TASK 2

a. Write a C program to swap two numbers using the following .
   i. Using third variable
   ii. Without using third variable
   iii. Using bitwise operators
b. Write a C program to add two numbers without using arithmetic operators in c?

TASK 3

a. Write a C program to find the roots of a quadratic equation using if-else.
b. The program should request the user to input two numbers and display one of the following as per the desire of user. (a). Sum of numbers (b) difference of numbers (c) product of the numbers (d)division of the numbers. Write a C program using switch statement to accomplish the above task.

TASK 4

a. Write a C Program check whether a given number is perfect number or not.
b. Write a C Program check whether a given number is palindrome number or not.
c. Write a C Program check whether a given number is Armstrong number or not.

TASK 5

a. Write a C program to display the following patterns.

i)
```
1
2 3
4 5 6
7 8 9 10
```

ii.
```
1
2 3
4 5 6
7 8 9 10
```

b. Write a C program to generate the prime numbers between x and y where x and y are starting and ending values to be supplied by the user.
c. Write a C program to calculate the following Sum:a. Sum=1+x/1!-x2/2!+x3/3!-x4/4!+…..xn/n!

TASK 6

1) Write a C program to find sum, average and minimum and maximum in a list of numbers.
2) Write a C program to implement linear search.
3) Write a C program to implement binary search.

TASK 7

a. Write a C program to implement matrix addition
b. Write a C program to implement matrix multiplication.

TASK 8

a. Write a C program to implement the following string handling functions.i.strlen() ii.strcpy() iii.strcmp() iv.strcat()
b. Write a C program to read first name , middle name and last name of a student and display a stringfull name without using string handling functions.

TASK 9

a. Write a C program to determine if a String is Palindrome or not.
b. Write a C program to sort the names of n students in the alphabetical order.

TASK 10

a. Write a C program to implement the following using recursive and non-recursive functions to findthe factorial of a given integer.
b. Write a C program to implement the following using recursive and non-recursive functions to findthe GCD (greatest common divisor) of two given integers

TASK 11

a. Write a C program to implement transpose of a matrix using functions.
b. Write a C program to display binary equivalent of a given decimal number.

TASK 12

a. Create astructure student with name ,rollno,marks of 3 subjects as members . Write a c programto sort student details based on total using structures and functions .
b. Write a C program that uses structures and functions to perform the following operations:
   i. Addition of two complex numbers
   ii. Subtraction of two complex numbers
   iii. Multiplication of two complex numbers

TASK 13

a. Write a C program using functions and pointers that compares two strings to see whether they are identical. The function returns 1 if they are identical, 0 otherwise.
b. Write a C program to sort list of numbers using pointers.

TASK 14

a. Write a C program to implement following pre-processor directives.
   i. define ii. ifdef iii. undef iv. ifndef.
b. Write a C program to create a user defined header file to find sum, product and greatest of two numbers ?

TASK 15

a. Write a C program to merge two files into a third file.
b. Write a C program to find some of n numbers using command line arguments.

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall ofIndia
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.4.HerbertSchildt, C: The Complete Reference, McGraw Hill, 4th Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course Code: GR20A1015 **L/T/P/C: 0/0/2/1**
I Year I Semester

Course Objectives:

1. Facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
2. Sensitize students to the nuances of English speech sounds, word accent, intonation rhythmand Neutralization of accent for intelligibility
3. Bring about a consistent accent and intelligibility in students' pronunciation of English byproviding an opportunity for practice in speaking
4. Improve the fluency of students in spoken English and neutralize their mother tongueinfluence
5. Train students to use language appropriately for public speaking and interviews

Course Outcomes:

1. Interpret the role and importance of various forms of communication skills.
2. Demonstrate the skills needed to participate in a conversation that builds knowledgecollaboratively by listening carefully and respect others point of view.
3. Utilize various media of verbal and non-verbal communication with reference to variousprofessional contexts.
4. Recognize the need to work in teams with appropriate ethical, social and professionalresponsibilities.
5. Evaluate and use a neutral and correct form of English.

English Language and Communication Skills Lab (ELCS) shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab

Exercise I CALL Lab:

Understand: Introduction to Phonetics – Speech Sounds – Consonant and Vowel Sounds.
Practice: Introduction to Phonetics– Speech Sounds – Vowels and Consonants.
ICS Lab:
Understand: Ice Breaking and JAM.
Practice: Ice-Breaking Activity and JAM Session. Introducing oneself and others

Exercise II CALL Lab:

Understand: Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.
ICS Lab:
Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette

Exercise III

CALL Lab: -Errors in Pronunciation-the Influence of Mother Tongue (MTI).

Understand: Intonation--Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.
ICS Lab:
Understand: Debates- argumentative vs persuasive - Public Speaking – Exposure to Structured Talks.
Practice: Debates- Making a Short Speech – Extempore.

Exercise IV CALL Lab:
Understand: Listening Skills and its importance-– Purpose- Process- Types- Barriers of Listening.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: How to make informal and Formal Presentations
Practice: Collages / Poster Presentations-Power point presentations

Exercise V CALL Lab:
Understand: Listening for General/Specific Details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: Story Telling – Narrating a story – Using appropriate language elements
Practice: Weaving Stories

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab
2. Interactive Communication Skills (ICS) Lab

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LIFE SKILLS AND PERSONALITY DEVELOPMENT (LSPD)

Course Code: GR20A1021 **L/T/P/C: 2/0/0/1I**
Year I Semester

Course Objectives:

1. Understand the concepts such as "Time Management", "Managing Information Overload" and "How to cope with Peer pressure".
2. Become familiar with concepts like how to master "English Language Skills" and "Communication skills".
3. Be thorough with the '"science behind personal health management and addictions" and stress management.
4. Appreciate the importance of cultivating good hobbies, need for forming good habits and discarding bad habits and how to hold difficult conversations in crisis situations.
5. Understand the importance of creative thinking, continuous and lifelong learning and cross culture sensitization. They will know what is meant by collaboration and team working.

Course Outcomes:

1. Apply the concept of Time Management to his own day to day life. They will also learn to cope with Information Overload, which has become a serious problem for the digital generation. They will be in a position to withstand harmful peer pressure, and steer themselves towards attaining their own objectives in the four years time they spend in the college.
2. Apart from understanding the importance of English language skills in a globalized world, they will leart the methodologies as to how they can master English Language skills. They will become familiar with the communication skills and etiquette, body language, non-verbal communication and they will start applying these concepts in their day to day life. This will help them to become thorough professionals in their career.
3. Large number of students are ignorant about the need for personal health management and the need to stay away from addictions. After this course, they will get a complete understanding of the biological basis behind these concepts. This will help them to maintain a robust health trough out their life and it will also keep them away from addictions like drug addiction, alcohol addiction & video games addiction. They will learn the techniquesof stress management as well.
4. They would start cultivating some good hobbies which will help them to maintain ideal work-life balance throughout their life. The students would start discarding bad habits & will start picking up good habits. Further, they will learn the techniques of holding difficult conversations and negotiations, which is an important skill set in the 21st century world.
5. They will develop the aptitude for finding creative solutions to problems and they will come to realize the importance of continuous and lifelong learning in a fast changing technological landscape. They will appreciate why collaboration and team working skills are important for success in a modern world.

UNIT I

Introduction to life skills: Why life skills are important for students. Highly competitive job market; companies test not only Engineering knowledge but also life skills; Fast paced changes in technologies; proliferation of electronic gadgets and harmful online content; Even to perform well in B.Tech, students need basic life skills.

Time management: What is meant by time management; Impulsive behaviorVs goal directive behavior; The concept of time log; What are the usual time wasters for students; How to minimize time wasters.

Information overload and how to cope with it: ICT revolution; proliferation of electronic media; Exponential growth in online content; Impact of information overload on human brain; How information overload interferes with student learning.

UNIT II

How to master English Language Skills: Importance of English in a globalized world; For any engineer, the whole world is his job market; Companies conduct exams, interviews & group discussions in English; Interdependence of communication skills & language skills; Entrance exams to foreign universities test English language skills; What are the various language skills; Practical strategies to improve one's English language skills.

Communication Skills: What is communication; Various types of communication's; Why communication skills are important in the modern world; Importance given to communication by companies during recruitment; Barriers to effective communication; Practical strategies to improve one's communication skills.

Body language, Etiquette and Non-Verbal communication: What is etiquette, grooming, attire & body language? Why these are important in the modern world; What kind of etiquette is expected by companies; How success in career & life is interlinked to etiquette, grooming, attire & body language; practical steps to improve one's etiquette, grooming, attire & body language.

UNIT III

Science behind personal health management: Widespread ignorance in society on health issues; WHO definition of Health; Human evolution; Hunting & Gathering lifestyle; Importance of physical work for human body & mind; Dangers of sedentary lifestyle; Germ diseases Vs Lifestyle diseases; How to integrate physical exercise into daily life.

Science behind Addictions: What is an addiction? Neurology and hormonal basics of addictive behavior; How addictions are formed; Harmful effects of addictions on physical health & mental health; How to recognize the addictions in oneself; How to come out of addictions.

Stress management: What is stress; Various stressors faced by a student; Fight & Flight response of humans; Harmful effects of chronic stress; Symptoms of poor coping skills of stress; Stress & Psychiatric problems; Easy coping strategies for stress.

UNIT IV

Need for cultivating good hobbies: Why hobbies are important for maintaining work-life balance; how hobbies help in maintaining good physical and mental health, what are various hobbies.

What is habit? Why it is so important. How to cultivate good habits & discard bad habits: Why habits are critical for successful life; How habits forms; How to analyze one's own habits; How to recognize useless & harmful habits; How to cultivate & Sustain useful habits; Difference between hobby & habit.

Peer pressure and how to cope with it: Human being is a social animal; Physical pain & social pain; How to be aware of harmful social pressure; Role of prefrontal cortex in judgment and decision making; why teenagers are vulnerable to peer pressure; strategies to overcome harmful peer pressure.

UNIT V

Continuous & lifelong learning: Accelerated change in technology landscape; shorter & shorter life cycles of technologies; Need for continuous learning ; Engineering knowledge alone is not enough to solve the real-life problems.

Cross culture sensitization: What is culture; why there are different cultures; How to understand culture; Today all workplaces are multi-cultural; How stereotypes develop in the mind about other cultures; Dangersof stereotypes & culture hatred prevailing society; How to overcome the culture prejudices.

Collaboration & team working skills. Why collaboration is important to succeed in one's own career, Today's workplace is all about teams, what is team working, what are various team working skills, how to be a good team member.

Textbooks:

1. The story of the human body by Daniel E Lieberman, Published by Pantheon Books, 2013
2. Spark by Dr. John J Ratey, *Publisher* Little Brown *Spark* 01-01-2013.
3. Creative thinking by Edward De Bono, Publisher: Penguin UK (25 October 2016).

References:

1. The power of positive confrontation by Barbara Pachter; Publisher: Da Capo Lifelong Books(November 28, 1999) ...
2. Habit by Charles Duhigg, Publisher: Random House Trade Paperbacks,2012
3. Communication skills for engineers and scientists by Sangeetha Sharma and Binod Mishra, PHILearning, 2009.
4. Time management by Brian Tracy, Publisher: AMACOM, 2014

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Code: GR20A1002 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives:

1. Knowledge to solve engineering problems governed by differential equations
2. The skill of evaluating multiple integrals needed for applications in mechanics and electro-magnetic field theory
3. The knowledge to interpret the functions arising in vector field theory and utilize mathematical tools for some computations
4. The skill of evaluating work done by a field and flux across a surface
5. The skill of utilizing specialized theorems for fast evaluation of work and flux

Course Outcomes:

1. Classify the differential equations of first order and solve them analytically by suggestedmethods
2. Solve linear differential equations of higher order under various forcing functions
3. Evaluate double and triple integrals and apply them to some problems in geometry and mechanics
4. Apply vector differential operators on scalar and vector fields and apply them to solve somefield related problems
5. Apply classical vector integral theorems for fast evaluation of work done around closed curves and flux across closed surfaces

UNIT I
ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

LDE of the first order:Solution of Exact, Linear and Bernoulli equations, modeling Newton's law of cooling, growth and decay models, modeling of R-L circuit

UNIT II
ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

LDE with constant coefficients: Complementary function, over damping, under damping and critical damping of a system, Particular integrals for *f(x)* of the form e^{ax}, x^n, $cosax$, $sinax$, $e^{ax}V(x)$ and x $V(x)$where $V(x) \equiv cosax$ and $sinax$, the method of variation of parameters LDE with variable coefficients: Cauchy's homogeneous equation, Legendre's homogeneous equations.

UNIT III
MULTIPLE INTEGRALS

Double integrals:Evaluation of Double Integrals, change of order of integration (only Cartesian form), change of variables (Cartesian and polar coordinates)

Triple Integrals:Evaluation of triple integrals, Change of variables (Cartesian to Spherical and Cylindrical polar coordinates)

Applications: Area using the double integral –Volume of a solid using the double and triple integral- Mass, Center of mass and Center of gravity using double and triple integrals

UNIT IV

VECTOR DIFFERENTIATION AND LINE INTEGRATION

Vector differentiation:Scalar and vector point functions, Concepts of gradient, divergence and curl of functions in cartesian framework, solenoidal field, irrotational field, scalar potential Vector line integration: Evaluation of the line integral, concept of work done by a force field,Conservative fields

UNIT V

SURFACE INTEGRATION AND VECTOR INTEGRAL THEOREMS

Surface integration: Evaluation of surface and volume integrals, flux across a surface Vector integral theorems: Green's, Gauss and Stokes theorems (without proof) and theirapplications

TEXT BOOKS

1. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa publishing house, Fourth edition 2014
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
4. 4.. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES:

1. GRIET reference manual
2. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY

Course Code: GR20A1005 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives:

1. To relate how the basic concepts and principles of chemistry can be applied to practical utility in a broader perspective of the society.
2. To distinguish the ranges of electromagnetic spectrum and its interaction with matter and to develop knowledge of various spectroscopic techniques at atomic and molecular levels.
3. To identify and apply various principles of electrochemistry, corrosion and water treatment which are essential for an engineer in industry
4. To acquire knowledge of existence of different organic molecules in different stereo chemical orientations useful for understanding reaction pathways.
5. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.

Course Outcomes:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Relate electromagnetic spectra used for exciting different molecular energy levels in various spectroscopic techniques and their application in medicine and other fields.
3. Recognize various problems related to electrochemistry and corrosion in industry and is able to explain different prevention techniques and apply concepts of chemistry in engineering.
4. Know the origin of different types of engineering materials used in modern technology and Interpret different problems involved in industrial utilization of water.
5. Understand the processing of fossil fuels for the effective utilization of chemical energy.

UNIT I
Atomic and Molecular Structure: (8 Lectures)
Atomic and molecularorbitals, Linear Combination of AtomicOrbitals (LCAO), Molecularorbitals of homo-nuclear diatomic molecules, MO energy diagrams of N_2, and O_2.
Metallic bonding, Valence Bond Theory, Crystal Field Theory, Crystal Field Splitting of transition metal ion d-orbitals in tetrahedral, octahedral, and square planar geometries.

UNIT II
Spectroscopic Techniques and Applications: (10 Lectures)
Regions of electromagnetic spectrum, Molecular spectroscopy Rotational Spectroscopy: Rotation ofmolecules, rotational spectra of rigid diatomic molecules, selection rules.
Vibrational Spectroscopy: The vibrating diatomic molecule, simple and an harmonic oscillators ofa diatomic molecule, selection rules, applications of IR spectroscopy.
NMR Spectroscopy: criteria for NMR activity (Magnetic and nonmagnetic nuclei), basic conceptsand principle of 1H NMR spectroscopy, Chemical shift, Magnetic Resonance Imaging.

UNIT III
Electrochemistry and Corrosion: (12 Lectures)
Electrochemistry: Electrode potential, types of electrodes: calomel and glass electrodes-construction and working, electrochemical series and applications, electrochemical cells: Galvanic & electrolytic cells, Nernst equation- applications, numerical problems, Batteries: primary and

secondary types, lithium metal, lithium ion and lead acid batteries. Types of Fuel cells: hydrogen-oxygen fuel cell - applications and advantages, microbial fuel cell.

Corrosion: Definition ,causes and effects of corrosion, The ories of chemical and electro chemical corrosion with mechanism, Types of corrosion - Galvanic, concentration cell and pitting corrosions, factors affecting corrosion (Nature of metal & Nature of Environment), corrosion control methods: Proper designing, cathodic protection (sacrificial anodic and impressed current cathodic protection), Metallic coatings: Hot dipping- Galvanization and tinning, electroplating, electroless plating of nickel.

UNIT IV

Engineering Materials and Water Technology: (8 Lectures)

Semiconductors: Si and Ge, preparation, purification and crystal growth by zone refining and Czochralski pulling methods, doping.

Polymeric Materials: plastics-classification, types of polymerization, properties of polymers-crystallinity, Compounding and fabrication by compression moulding and injection moulding, conducting polymers – definition, classification, applications of conducting polymers in mobile phones and displays.

Water: impurities, hardness-causes of hardness, types, Units, Total Dissolved Solids (TDS), Boiler troubles-scales and sludges, caustic embrittlement, water purification by reverse osmosis (RO)method.

UNIT V

Stereochemistry and Energy Resources (8 Lectures)

Stereo chemistry: Representations of 3D structures for organic molecules, stereo isomers: Conformational and Configurational isomers. Conformational isomers: conformational analysis of n-butane. Configurational isomers: geometrical isomers (E, Z isomers) and optical isomers. Optical isomers: symmetry, chirality, enantiomers, diastereomers, optical activity. Structure, synthesis and pharmaceutical applications of aspirin and ibuprofen.

Energy sources: Fossil Fuels: Coal –types, analysis of coal- proximate and ultimate analysis and their significance, Petroleum-its composition-synthetic petrol – Fischer Tropsch's process, cracking - Definition and its significance, knocking and its mechanism in Internal Combustion engine, Octane rating, Composition and Uses of Natural gas, LPG and CNG, biodiesel synthesis, biogas.

Text Books:

1. Engineering chemistry by P.C. Jain and M. Jain; DhanpatRai Publishing Company (P) Ltd., NewDelhi.
2. Textbook of Engineering Chemistry by A. Jayashree, Wiley Publications

References:

1. Organic Chemistry by Morrison, Boyd &Bhattacharjee (Pearson Pubs) Solomons' Organic Chemistry, Wiley pubs
2. Fundamentals of Molecular Spectroscopy, by C.N. Banwell. McGraw Hill Publication
3. A Textbook of Engineering Chemistry by Shashi Chawla, DhanpatRai Publishing Company (P)Ltd., New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING MECHANICS

Course Code: GR20A10 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives:
1. Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium.
2. Perform analysis of bodies lying on rough surfaces.
3. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections.
4. Determine the forces in the members of the trusses.
5. Explain the concepts of work-energy method, impulse-momentum and its applications to translation, rotation and plane motion.

Course Outcomes:
1. Determine resultant of forces acting on a body and analyze equilibrium of a body subjectedto a system of forces.
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Determine the forces in the members of the trusses
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion of rigid bodies.

UNIT I
INTRODUCTION TO ENGINEERING MECHANICS - FORCE SYSTEMS
Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems ; Static Indeterminacy

UNIT II FRICTION
Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw Centroid and Centre of Gravity-Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications.

UNIT III
AREA MOMENT OF INERTIA
Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem, Mass Moment of Inertia , Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies

UNIT IV

ANALYSIS OF TRUSSES

Introduction, Classification of trusses, Assumptions made in the analysis of perfect truss, Methods of Analysis of Trusses- Method of Joints and Method of Sections. Principle of Virtual Work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibriums.

UNIT V

REVIEW OF PARTICLE DYNAMICS

Rectilinear motion, Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion, Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work- kinetic energy, power, potential energy. Impulse-momentum (linear, angular), Impact (Direct and oblique).

Text/Reference Books:

1. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics – Statics & Dynamics
2. A. Nelson, "Engineering Mechanics: Statics & Dynamics", Tata McGraw-Hill Education, 2009.
3. Timoshenko S.P and Young D.H., "Engineering Mechanics", McGraw Hill International Edition, 1983.
4. Andrew Pytel, JaanKiusalaas, "Engineering Mechanics", Cengage Learning, 2014.
5. Beer F.P & Johnston E.R Jr. "Vector Mechanics for Engineers", TMH, 2004.
6. Hibbeler R.C & Ashok Gupta, "Engineering Mechanics", Pearson Education, 2010.
7. Tayal A.K., "Engineering Mechanics – Statics & Dynamics", Umesh Publications, 2011.
8. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2008.
9. Meriam. J. L., "Engineering Mechanics", Volume-II Dynamics, John Wiley & Sons, 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES

Course Code: GR20A1011 **L/T/P/C: 2/1/0/3**

I Year II Semester

Course Objectives:

1. To impart the basic concepts of data structures, algorithms and various searching and sortingtechniques.
2. To demonstrate operations of linear data structures like stacks and queues.
3. To develop algorithms to implement operations on linked lists.
4. To demonstrate operations of non-linear data structures trees and graphs.
5. To realize the merits and demerits and applications of various data structures.

Course Outcomes:

1. Analyze basic concepts of data structures, computation complexity and implement varioussearching and sorting techniques.
2. Apply various operations on linear data structures Stack and Queue and their applications.
3. Develop algorithms for operations on linked lists and convert them to programs.
4. Apply various operations on non-linear data structure tree.
5. Implement various graph traversals techniques and idea of hashing.

UNIT I

Sorting: Bubble sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort (Algorithms and implementation)

Algorithms: Analysis of algorithms, Basic concept of order of complexity, Asymptotic Notations: Big Oh notation, Omega notation, Theta notation, Little oh notation and Little omega notation.

UNIT II

Stacks: Introduction to Data Structures: Basic Stack Operations-pop, push, display, delete. Representation of a Stack, Implementation of stack using Arrays, Stack Applications: Recursion, Infix to postfix Transformation, Evaluating Post-fix Expressions

Queues: Basic Queue Operations-enqueue, dequeue, Representation of a Queue using array, Implementation of Queue Operations using arrays, Applications of Queues, Circular Queue.

UNIT III

LIST: Introduction, Dynamic memory allocation, single linked list, Advantages and disadvantages of Single linked list ,Single linked list VS Arrays, Representation of a linked list in memory, Operations-insertion, deletion, display, search, Implementation of stack, queue using linked list. Circular linked list, Double linked list.

UNIT IV

TREES: Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, Operations on a Binary Search Tree, Binary Search Tree Traversals (recursive), Creation of binary tree from traversals.

UNIT V

Graphs: Definition, Basic Terminology, Representation of Graphs, Graph Traversal Techniques – Breadth First Traversal, Depth First Traversal. Introduction to Hashing (no implementation).

TEXT BOOKS:

1. Data Structures, 2/e, Richard F, Gilberg, Forouzan, Cengage
2. Data Structures and Algorithms, 2008, G. A. V. Pai, TMH

REFERENCE BOOKS:

1. Data Structure with C, Seymour Lipschutz, TMH
2. Classic Data Structures, 2/e, Debasis, Samanta, PHI, 2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz, Sahni, Anderson Freed, University Prees

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY LAB

Course Code: GR20A1014 **L/T/P/C: 0/0/3/1.5**
I Year II Semesters

Course Objectives:

1. Introduce practical applications of chemistry concepts to solve engineering problems.
2. To determine the rate constant of reactions from concentrations as a function of time.
3. Measure the molecular or ionic properties such as conductance, redox potentials
4. Synthesize a drug molecule to learn how organic compounds are prepared in industry.
5. Know the laboratory practices implemented in a research and industrial chemistry laboratory setting.

Course Outcomes:

1. Ability to perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.
2. Determination of parameters like hardness and chloride content in water, measurement of redox potentials and conductance.
3. Understand the kinetics of a reactions from a change in concentrations of reactants or products as a function of time.
4. Synthesize a drug molecule as an example of organic synthesis methods widely used in industry.
5. Determination of physical properties like adsorption and viscosity.

List of Experiments: (any 12 experiments out of 14)

1. Determination total hardness of water by complexometric method using EDTA.
2. Determination of chloride content of water by Argentometry.
3. Redox titration: Estimation of ferrous iron using standard KMnO4
4. Estimation of HCl by Conduct ometrictitrations
5. Estimation of Acetic acid by Conduct ometrictitrations
6. Estimation of Ferrous iron by Potentiometry using dichromate
7. Determination of rate constant of acid catalyzed reaction of methylacetate
8. Determination of acid value of coconutoil.
9. Adsorption of acetic acid by charcoal
10. Determination of surface tension of liquid by using stalagmometer
11. Determination of viscosity of liquid by using Ostwald'sviscometer.
12. Determinationofpartitioncoefficientofaceticacidbetweenn-butanolandwater.
13. Synthesis of Aspirin
14. Synthesis of Paracetamol.

Reference Books:

1. Vogel's text book of Practical organic chemistry, 5thEdition.
2. Senior Practical Physical Chemistry, B.D. Khosala, A. Gulati and V. Garg (R. Chand & Co.,Delhi)
3. Text book on experiments and Calculations in Engineering Chemistry-S.S.Dara.
4. 0An introduction to practical chemistry, K.K. Sharma and D.S. Sharma (VikasPublications, NewDelhi)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES LAB

Course Code: GR20A1018 **L/T/P/C: 0/0/2/1I**

Year II Semester

Course Objectives:

1. To work with sorting techniques.
2. To translate algorithms to programs.
3. To develop programs to implement basic data structures.
4. To develop modular, reusable and readable C Programs.
5. To implement tree and graph traversals.

Course Outcomes:

1. Formulate the algorithms for sorting problems and translate algorithms to a working and correct program.
2. Implement stack and queue data structures and their applications.
3. Interpret linked list concept to produce executable codes.
4. Develop working procedure on trees using structures, pointers and recursion.
5. Implements graph traversal techniques

TASK 1

a. Implement Bubble sort using a C program.
b. Implement Selection sort using a C program.
c. Implement Insertion Sort using a C program.

TASK 2

a. Implement Quick sort using a C program.
b. Implement Merge sort using a C program.

TASK 3

a. Implementation of Stack operations using arrays in C.
b. Implementation of Queue operations using arrays in C.

TASK 4

a. Write a c program to convert Infix to Postfix expression.
b. Write a c program to evaluate a Postfix expression

TASK 5

a. Implement Circular Queue operations in C.

TASK6

a. Implement Single Linked List operations in C.

TASK 7

a. Implement Circular Linked List operations in C.

TASK 8

a. Implement Double Linked List operations in C.

TASK 9

a. Implement the following operations on Binary Search Tree.
   i. Create
   ii. Insert
   iii. Search

TASK 10

a. Implement Preorder, Inorder and Postorder traversals of Binary Search Tree usingrecursion in C.

TASK 11

a. Implement Depth First Traversal on graphs in C.

TASK 12

a. Implement Breadth First Traversal on graphs in C.

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

Text Books:

1. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage
2. Data Structures and Algorithms, 2008, G. A.V.Pai, TMH

References:

1. Data Structure with C, Seymour Lipschutz, TMH
2. Classic Data Structures, 2/e, Debasis,Samanta,PHI,2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz, Sahni, Anderson Freed, University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING WORKSHOP

Course Code: GR20A1019 **L/T/P/C: 1/0/ 3/2.5**
I Year II Semester

Course Objectives:

1. To prepare and practice of scientific principles underlying the art of manufacturing in workshop/manufacturing practices.
2. To demonstrate basic knowledge of various tools and their use in different sections.
3. To make students to execute applications of various tools in carpentry.
4. To make students recognize applications of manufacturing methods casting, forming machining, joining and advanced manufacturing methods.
5. To develop generate safety rules, safe practices and workshop dress code.

Course Outcomes:

1. Develop various trades applicable to industries / Manufacturing practices.
2. Create Hands on experience for common trades.
3. Improve to fabricate components with their own hands.
4. Develop practical knowledge on the dimensional accuracies and dimensional tolerances possible with various manufacturing processes.
5. To build the requirement of quality of work life on safety and organizational needs.

TRADES FOR EXERCISES: At least two exercises from each trade:

1. Carpentry
2. Fitting Shop
3. Tin-Smithy
4. Casting
5. Welding Practice
6. House-wiring
7. Black Smithy
8. **VIDEO LECTURES:** Carpentry, Fitting operations, Tin-Smithy, Casting, Welding, Electrical and Electronics, Black Smithy, Plumbing, Power tools in construction and Wood Working, Manufacturing Methods,

Text/ Reference Books:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal /Anuradha.
3. Work shop Manual - P. Kannaiah/ K. L. Narayana/SciTech
4. Workshop Manual / Venkat Reddy/BSP
5. Workshop Manual/K. Venugopal/Dr.V. Prabhu Raja/G.Sreekanjan

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN THINKING

Course Code: GR20A1020 **L/T/P/C: 2/0/0/1**
I Year II Semester

Course Objectives

1. Study a problem from multiple perspectives
2. Learn how to frame the design challenge properly.
3. Learn how to ideate, prototype and Iterate solutions.
4. Learn from the overall design process how to create value as entrepreneurs
5. Learn how to design successful products or enterprises

Course Outcomes

1. Students will be able to identify an Opportunity from a Problem
2. Students will be able to frame a Product/Service Idea
3. Students will be able to empathize with the customers
4. Students will be able to design and develop a Prototype
5. Students will be able to pitch their idea

UNIT I

Introd ction to Design Thinking: LRI Assessment, Introduction to Design Thinking, Understanding the Mindsets-Empathy, Optimism, Embrace Ambiguity, Make it, Learn from Failure, Iterate, Create Confidence, Creativity Convergent & Divergent Thinking

UNIT II

Design Thinking Methodology: The 5 Stages of the Design Thinking Process-Empathise, Define (the problem), Ideate, Prototype, and Test,

UNIT III

Ideation tools & exercises. Sample Design Challenge, Introduction to the Design Challenge Themes,Story telling and Tools for Innovation

UNIT IV

Empathize-Understand customers, Empathy Maps, Empathise-Step into customers shoes-Customer Journey Maps, Define- Analysis & Drawing Inferences from Research

UNIT V:

The Design Challenge: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing-Documentation and the Pitch

TEXT BOOKS:

1. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School - IdrisMootee.

REFERENCE BOOKS:

1. Zero to One: Note on Start-Ups, or How to Build the Future
2. The Lean Startup: How Constant Innovation Creates Radically Successful Businesses
3. Start With Why: How Great Leaders Inspire Everyone To Take Action

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

KINEMATICS OF MACHINERY

Course Code: GR20A2038 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Objectives:

1. Understand the kinematics and rigid-body dynamics of kinematically driven machine components.
2. Understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
3. Able to design some linkage mechanisms and cam systems to generate specified output motion.
4. Understand the kinematics of gear trains.
5. Estimate of transmission of power by belts drives.

Course Outcomes:

1. Identify, select and design various types of linkage mechanisms for obtaining specific motion with lower pairs and higher pairs.
2. Analyse analytical and graphical aspects of linkage mechanisms for optimal functioning.
3. Drawing displacement diagrams and cam profile diagram for followers executing differenttypes of motions for various configurations of followers.
4. Evaluate gear tooth geometry and select appropriate gears for the required applications.
5. Understand the concept of friction in bearings, clutches, brakes and belt drives.

UNIT I

Classification of mechanisms, Basic kinematic concepts and definitions-Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions- Mechanical advantage-Transmission angle-Description of some common mechanisms-Quick return mechanism, straight line generators-Universal Joint-Rocker mechanisms

UNIT II

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations-kinematic analysis of simple mechanisms-slider crank mechanism dynamics-Coincident points-Coriolis component of acceleration-introduction to linkage synthesis-three position graphical synthesis formation and path generation.

UNIT III

Classification of cams and followers-Terminology and definitions-Displacement diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions-derivatives of follower motions-specified contour cams-circular and tangent cams-pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers.

UNIT IV

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/ under cutting-helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT V

Surface contacts-sliding and rolling friction-friction drives-bearings and lubrication-friction clutches-belt and rope drives-friction in brakes.

Text/Reference Books:

1. Thomas Bevan, Theory of Machines, 3 edition, CBS Publishers & Distributors, 2005.
2. Cleghorn W.L.Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L.Norton, Kinematics and Dynamics of Machinery, Tata Mc Graw Hill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-WestPvt. Ltd, New Delhi, 1988.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MATERIALS ENGINEERING

Course Code: GR20A2039 **L/T/P/C: 2/1/0/3**
II Year I Semester

Course Objectives:

1. Understand the concepts of fundamental science and engineering relevant to materials, various mechanical property measurements.
2. Categorize the various equilibrium diagrams and describe the changes which occurs on metals.
3. Explain the concepts on various heat treatment operations.
4. Categorize the various ferrous and nonferrous metals with their properties and applications.
5. Expose the concepts on composites, ceramics materials with their properties and applications.

Course Outcomes:

1. Relate crystal structures and identify the suitable method for mechanical property measurements.
2. Relate the equilibrium transformation diagrams for various metals.
3. Utilize appropriate techniques in treating a metal with proper heat treatment operations.
4. Have knowledge on different types of ferrous and nonferrous metals.
5. Identify the suitable composite and ceramic material for the required application.

UNIT I

Structure of metals & mechanical property measurements: Bonds in Solids, crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal, determination of grain size. Imperfection in solids: Point, line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, Tensile, compression and torsion tests; Young's modulus, true and engineering stress-strain curves, Hardness: Rockwell, Brinell and Vickers and their relation to strength.

UNIT II

Alloys & Phase diagrams: Necessity of alloying, Solid solutions, Types of Solid Solutions, Hume Rothery's rule, Intermediate alloy phases, effects of various alloying elements on steels, microstructure development, eutectic, peritectic, peritectoid. Iron Iron-carbide phase diagram and micro structural aspects of ledeburite, Austenite, Ferrite, Martensite and Cementite.

UNIT III

Heat treatment of steel: Annealing, Tempering, Normalizing, Hardening, Jominey quench Test for Hardenability, isothermal transformation diagrams, Continuous cooling curves and interpretation of final microstructures, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame , induction & cryogenic hardening.

UNIT IV

Ferrous & Non ferrous metals: Steels, Types of steels, Properties and applications of Plain carbon steels, stainless steel and tool steels, maraging steels, cast irons; grey, white, malleable

and spheroidal cast irons, copper and copper alloys, aluminium, alloys-Nickel based super alloys and Titanium alloys.

UNIT V

Ductile, brittle failures, composites & ceramics: Stress strain curves for brittle and ductile materials, differences between brittle and ductile fractures, Tresca, Von-mises, Maximum normal stress, Griffith criterion, Fatigue failure, SN curve, ceramics, glasses, cermets, abrasive materials, Composite materials: Classification of composites, various methods of manufacture of composites, particle–reinforced materials, fibre-reinforced materials, metal ceramic mixtures, metal–matrix composites and Carbon–Carbon composites.

Text/Reference Books:

1. W.D.Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G.Budinski and Michael K.Budinski, “Engineering Materials”, Prentice Hall
3. V.Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
4. U.C.Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

CourseCode: GR20A2017 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Objectives:

1. Prepare the students a basic knowledge in the analysis of Electric Circuits.
2. Provide students with a strong back ground in induction machines, speed control techniques and its characteristics and different types of machines existing in present trend.
3. Train the students to have the solid foundation in technical concepts required to engineering problems.
4. Train the students in understanding the usage of electronic instruments in measuring techniques.
5. Have a thorough understanding on transistors and its uses

Course Outcomes:

1. Interpret and familiar with ac and dc circuits solving.
2. An ability to find role of electrical machinery in simple & complex applications.
3. To demonstrate the designing and conducting experiments, to analyze and interpret data and also provides the ability to visualize and work on laboratory and multidisciplinary tasks.
4. Analyze performance of Transformers and Instruments.
5. Evaluate the working of Diodes.

UNIT I

ELECTRICAL CIRCUITS

Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, Capacitive networks, Series, Parallel circuits and Star-delta and deltastar transformations.

UNIT II

DC MACHINES AND AC MACHINES

Principle of operation of DC Generator – emf equation - types – DC motor types – torqueequation – applications – three point starter.

Principle of operation of alternators – regulation by synchronous impedance method – Principleof operation of induction motor – slip – torque characteristics – applications.

UNIT III

TRANSFORMERS AND INSTRUMENTS

Principle of operation of single phase transformers – EMF equation – losses – efficiency and regulation.Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

Cathode ray oscilloscope: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

UNIT IV

DIODE AND IT'S CHARACTERISTICS

P-N junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems).

UNIT V

TRANSISTORS

P-N-P and N-P-N Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

Text/Reference Books:

1. David V. Kerns, JR. J. David Irwin, Essentials of Electrical and Computer Engineering.
2. V.K.Mehta, S.Chand & Co, Principles of Electrical and Electronics Engineering.
3. M.S Naidu and S. Kamakshaiah, Introduction to Electrical Engineering, TMH Publications.
4. Kothari and Nagarath, Basic Electrical Engineering, TMH Publications, 2nd Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
STRENGTH OF MATERIALS

CourseCode: GR20A2040 **L/T/P/C: 3/0/0/3**
II Year I Semester

Prerequisites: Knowledge in Engineering Mechanics (statics)
Course Objectives:

1. To provide the basic concepts and principles of strength of materials.
2. To study stresses, strains and elastic constraints of different materials.
3. To gain knowledge about shear stress and bending moment of different types of beams subjected to various loads.
4. To obtain knowledge about the effect of torsion on shafts.
5. To understand the flexural and shear stress concepts for different materials and shapesof structures.

Course Outcomes:

1. Understand the theory of elasticity including strain displacement and Hooke's law relationships.
2. Analyse the shear stresses and bending moment diagrams with various types of loads.
3. Calculate the slope and deflections in beams subjected to transverse loads.
4. Analyse various situations involving structural members subjected to combinedstresses and solve the torsion problems in bars.
5. Evaluate the bending and shear stresses in beams.

UNIT I

Simple stresses & strains: Concept of stresses & strains (linear, lateral, shear, thermal and volumetric), Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Stress-strain diagrams for ductile & brittle materials, Proof stress, True stress & strain - Various strengths of material- Yield strength, Ultimate tensile strength, Factor of safety, Strain energy-Gradual, sudden and Impact Loads.Concept of stress state, relation between elastic constants, Axial forces, stresses and strains in determinate and indeterminate composite bars, bars under axial loads and self-weight.

UNIT II

Shear force and Bending moment diagrams: Shear forces and bending moments of determinate beams due to concentrated loads, uniformly distributed loads, uniformly varying loads and couples, relation between hear Force and Bending Moment diagrams for cantilevers, simply supported beams, and their construction- Maximum bending moment & point of contra flexure.

UNIT III

Slope and Deflection of beams: Relation between BM & slope, slope & deflection of determinate beams, double integration method (Macaulay's method), derivation of formula for slope & deflection for standard cases

UNIT IV

Principal stresses and strains: Normal and shear stresses on any oblique plane - Concept of principal planes, derivation for principal stresses and maximum shear stress, position of principal planes & planes of maximum shear, graphical solution using Mohr's circle of stresses, combined effect of axial force, bending moment & torsional moment on circular shafts (solid as well as hollow).

Torsional stresses: Derivation of torsion equation, stresses, strain & deformations in solid & hollow Shafts, homogeneous & composite circular cross section subjected to twisting moment, stresses due to combined torsion, bending & axial force on shafts.

UNIT V

Stresses in machine elements:

Bending stresses: Theory of simple bending, assumptions, derivation of flexural formula, Bending of common cross sections (rectangular, I,T,C) with respective centroidal & parallel axes, bending stress distribution diagrams, moment of resistance and section modulus.

Shear stresses: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for I, T and C symmetrical sections, maximum and average shears stresses, shear connection between flange & web.

Text/Reference Books:

1. Strength of Materials: Ramamrutham.
2. Strength of Materials R K Bansal, Laxmi Publications.
3. Analysis of structures by Vazirani and Ratwani.
4. Mechanics of Structures Vol-III, by S.B.Junnarkar.
5. Strength of Materials by S.Timshenko.
6. Strength of Materials by Andrew Pytel and Ferdinond L.Singer Longman.
7. Solid Mechanics, by Popov.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
THERMODYNAMICS

Course Code: GR20A2041 **L/T/P/C: 3/0/0/3**
II Year I Semester

Note: Steam Table book Permitted
Course Objectives:

1. Understand the nature and role of the thermodynamic properties of matter such as internal energy, enthalpy, entropy, temperature, pressure and specific volume.
2. Interpret a thermodynamic system by a control mass or control volume, distinguish the system from its surroundings, and identify work and/or heat interactions between the system and surroundings
3. Identify and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another
4. Demonstrate the implications of the second law of thermodynamics and limitations on the performance of thermodynamic systems
5. Appraise the performance of Diesel engine, Petrol engine, Gas turbine, refrigeration and heat pump systems by means of Thermodynamic cycles

Course Outcomes:

1. Describe the first and second laws of thermodynamics and their application to a wide range of systems
2. Discuss the first law of thermodynamics and identify the various forms of work
3. Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
4. Execute the calculations of the efficiencies of heat engines and other engineering devices.
5. Explain and sketch the construction and principles governing the form of simple and complex one-component pressure-temperature diagrams and the use of volume- temperature and pressure-volume phase diagrams and the steam tables in the analysis of engineering devices and systems.

UNIT I

Fundamentals: System & Control volume, Property, State & Process, Exact & Inexact differentials, Thermodynamic definition of work, examples, Displacement work, Path dependence of displacement work and illustrations for simple processes, electrical, magnetic, gravitational, spring and shaft work.

Temperature, Definition of thermal equilibrium and Zeroth law, Temperature scales, Various Thermometers- Definition of heat, examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes, Concept of total energy E, Demonstration that E is a property, Various modes of energy, Internal energy and Enthalpy.

UNIT II

First Law for Flow Processes-Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.

Second law-Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

UNIT III

Clausius inequality, Definition of entropy S, Demonstration that entropy S is a property, Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes, Determination of s from steam tables-Principle of increase of entropy, Illustration of processes in T-s coordinates, Definition of Isentropic efficiency for compressors, turbines and nozzles-Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Second law analysis for a control volume, Exergy balance equation and Exergy analysis.

UNIT IV

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems-Const. temperature and Const. pressure heating of water, Definitions of saturated states, P-v-T surface, Use of steam tables and R134a tables, dryness fraction & measurement, Saturation tables, Superheated tables, Identification of states & determination of properties, Mollier's chart.

UNIT V

Thermodynamic cycles: Basic Rankine cycle, Basic Brayton cycle, Basic vapor compression cycle and comparison with Carnot cycle.

Text/Reference Books:

1. Sonntag, Borgnakke. C and Van Wylen,G.J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Cengel Y.A and Boles M.A. Thermodynamics an Engineering Approach. 7th Edition. McGraw-Hill Education
3. Jones.J.B. and Duggan,R.E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India.
4. Moran,M.J. and Shapiro,H.N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
5. Nag,P.K, 1995, *Engineering Thermodynamics*, Tata Mc Graw-Hill Publishing Co. Ltd.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MACHINE AND PRODUCTION DRAWING LAB

Course Code:GR20A2042 **L/T/P/C: 0/0/4/2**
II Year I Semester

Course Objectives:

1. To develop an understanding of the conventional representation of different materials andmachine parts.
2. To analyze the various limits, fits, tolerances and surface roughness symbols adopted inthe production drawings.
3. To provide an understanding on various forms of screw threads, nuts, bolts, joints and rivets.
4. To create assembly drawings of machine parts from the given part drawings.
5. To create part drawing assemblies by using specifications and standards.

Course Outcomes:

At the end of the course, the students will be able to

1. Understand the conventions used in Machine & production drawing.
2. Construct the machine elements including couplings, cotters, riveted, and bolted joints.
3. Determine limits and fits and allocate tolerances for machine components.
4. Construct an assembly drawing using part drawings of machine components.
5. Apply concepts and methods in the preparation of production drawings.

UNIT I
CONVENTIONAL REPRESENTATION

Materials, Machine elements, screw, riveted and welded joints. Springs, gears. electrical, hydraulic and pneumatic circuits. Types of section – drawing of sections and auxiliary sectional views.

UNIT II

a) Forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Cotter joint and knuckle joint.
c) Rivetted joints for plates.

UNIT III

a) Universal, Oldham coupling, journal and foot step bearings
b) Limits, fits and tolerance
c) Surface roughness and its indication

UNIT IV
ASSEMBLY DRAWINGS

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions. Engine parts – stuffing boxes, cross head, eccentric, petrol engine connecting rod, piston assembly.

UNIT V

PART DRAWINGS

Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc. Part Drawing Assemblies- Plummer block, Screw jack, Lathe tail stock. Valves: Feed check valve, air cock.

Text/Reference Books:

1. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers
2. Production and Drawing – K.L. Narayana & P. Kannaiah/ New Age
3. Machine Drawing – Dhawan, S. Chand Publications
4. Machine drawing with Auto CAD-Pohit and ghosh, PE
5. Machine Drawing – N. D. Bhatt
6. Machine Drawing – Rajput
7. Geometric dimensioning and tolerancing-James D. meadows/ B.S Publications
8. Engineering Metrology, R.K Jain, Khanna publications

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRENGTH OF MATERIALS LAB

Course Code:GR20A2043 **L/T/P/C: 0/0/3/1.5**

II Year I Semester

Prerequisites: Fundamentals of Engineering Mechanics, Mechanics of materials.

Course Objectives:

1. Opportunity to apply loads to various materials under different equilibrium conditions.
2. Perform tests on materials in tension, compression, torsion, bending, and impact.
3. Reinforce classroom theory by having the student perform required tests, analyze subsequent data, and present the results in a professionally prepared report.
4. Study engineering properties of materials, force-deformation, and stress-strain relationship.
5. Gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures.

Course Outcomes:

1. Determine the Young's modulus for ductile materials and analyze the compression strength of both ductile and brittle materials.
2. Analyze the various points on stress strain diagram and calculate the modulus of rigidity of ductile materials.
3. Calculate & Compare the hardness values for various materials.
4. Experiment on a spring to interpret the stiffness and shear modulus.
5. Apply the concept of impact loading and to determine impact values for various materials.

List of Experiments:

Task-1: To conduct hardness test on given material using Brinnel's Hardness testing equipment.
Task-2: To conduct hardness test on given material using Rockwell's Hardness testing machine.
Task-3: To conduct hardness test on given material using Vicker's Hardness testing machine.
Task-4: To perform the following tests on the given material using UTM (Universal Testing Machine)
a) Tension test to determine young's modulusand
b) Shear test to determine ultimate shearstrength
Task-5: To determine the stiffness and modulus of rigidity of the spring wire by performing Spring Test
Task-6: To perform compression test on cube to analyze compression strength of thematerial
Task-7: To determine the Young's modulus of the given structural material using Cantilever Beam set-up
Task-8: To determine the Young's modulus of given structural material using Simply Supported Beam set-up
Task-9: To determine the Young's modulus of given structural material by Maxwell's Reciprocal Theorem
Task-10: To determine the Young's modulus of given structural material using Continuous Beamset-up.

Task-11: To determine the Torsional strength and stiffness of a material using Torsion testing machine.
Task-12: To determine impact strength of the given material using Impact testing equipment(Izod and Charpy).

Teaching Methodology:

- Experimental Test rigs

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MATERIAL SCIENCE AND METALLURGY LAB

Course Code: GR20A2044 **L/T/P/C: 0/0/3/1.5**
II Year I Semester

Course Objectives:

1. Know the micro structure of different materials.
2. Know the properties of materials at higher elevated temperatures.
3. Refine grain size by various heat treatment processes.
4. Gain knowledge on various materials for product based on microstructure.
5. Know differences between ferrous and nonferrous metals with their properties.

Course Outcomes:

1. Relate properties to microstructure.
2. Choose suitable metals and alloys for industrial applications.
3. Find out the hardness of various treated and untreated metals.
4. Tell the chemical composition of various ferrous and nonferrous metals.
5. Select a suitable heat treatment process for a material.

List of Experiments:

1. Preparation and study of micro structure of Mild steel and Low carbon steel.
2. Preparation and study of micro structure of High carbon steel and Stainless steel.
3. Preparation and study of micro structure of Medium carbon steel.
4. Preparation and study of micro structure of Grey cast iron and White cast Iron.
5. Preparation and study of micro structure of Malleable cast iron and Spheroidal castiron.
6. Preparation and study of micro structure of Aluminium.
7. Preparation and study of micro structure of copper.
8. Preparation and study of micro structure of Titanium (Ti6Al4V).
9. Preparation and study of the micro structure of Inconel 718 –Super alloy.
10. Preparation and microscopic examination of heat treated and untreated metallic samples.
11. Hardenability of steels by Jominy End Quench test.
12. Find out the hardness of various treated and untreated steels.

Teaching Methodology:

- Experimental Test rigs & Microscopes

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

JAVA FOR ENGINEERS

Course Code: GR20A2007 **L/T/P/C: 2/0/0/2**

II Year I Semester

Course Objectives:

1. Analyze a software development problem and express its essence succinctly and precisely.
2. Understanding the OOP's concepts, classes and objects.
3. To learn how to extend Java classes with inheritance and dynamic binding.
4. To learn how to use exception handling in Java applications.
5. To understand how to design applications with threads in Java.

Course Outcomes:

1. Understand Java programming concepts in Program writing
2. Identify the model of Object-Oriented Programming: Abstract data types,Encapsulation, Inheritance and Polymorphism.
3. Break a problem into logical pieces that can be solved independently.
4. Incorporate exception handling in object-oriented programs.
5. Correlate the advantages of Multi-threading.

UNIT I

Introduction to OOP: Introduction, Need of object-oriented programming, principles of object-oriented languages, Applications of OOP, history of JAVA, Java Virtual Machine, Java features, Program structures, Installation of JDK.

UNIT II

Programming Constructs: Variables, Primitive data types, Identifiers- Naming Conventions, Keywords, Literals, Operators- Binary, Unary and Ternary, Expressions, Primitive Type conversion and casting, flow of control- branching, conditional, loops.

Classes and Objects- Classes, Objects, Creating objects, methods, constructors- constructor overloading, cleaning up unused objects- Garbage collector, class variable and methods- static keyword, this keyword, arrays, Command line arguments.

UNIT III

Inheritance: Types of Inheritance, Deriving classes using extends keyword, method overloading, super keyword, final keyword, abstract class.

Interfaces: Interface, Extending interface, interface Vs Abstract classes.

UNIT IV

Packages- Creating Packages, using Packages, Access protection, java I/O package. Exploring java.io and String classes.

Exceptions - Introduction, Exception handling techniques - try, catch, throw, throws, finally block, user defined Exception.

UNIT V

Multithreading: java.lang. Thread, the main Thread, creation of new Threads, Thread priority, multiThreading- using isalive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads.

Text/Reference Books:

1. Java: The Complete Reference, 10th edition, Herbert Schildt, McgrawHill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and DaleSkrien, TMH.
3. Java for Programming, P.J.Dietel PearsonEducation
4. Object Oriented Programming through Java, P.Radha Krishna, UniversitiesPress.
5. Thinking in Java, Bruce Eckel, PearsonEducation
6. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press

II YEAR

II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THERMAL ENGINEERING

Course Code: GR20A2045 **L/T/P/C: 3/0/0/3**

II Year II Semester

Pre-requisite: Thermodynamics

Course Objectives:

1. Apply the laws of Thermodynamics to analyze air standard cycles
2. Understand and evaluate the performance analysis of the major components andsystems of IC engines and their applications.
3. Analyze the processes to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
4. Explore to the components and working principles of rotary, reciprocating, dynamic and axial compressors.
5. Evaluation of parameters which influence the performance of the compressors in power plants, gas turbines and jet propulsions etc. for better engineering practice.

Course Outcomes:

1. Evaluate the performance of IC engines and compressors under the given operating conditions.
2. Apply the laws of Thermodynamics to evaluate the performance of IC Engines & Compressors
3. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance
4. Explain the function and working principles of rotary, reciprocating, dynamic and axial compressors
5. Elaborate the factors influence performance of the compressors by analytical and graphical methods using velocity triangles

UNIT I

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI Engines, Valve and Port Timing Diagrams, Air – Standard air-fuel and actual cycles.

Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process.

Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

Engine systems, cooling and lubrication systems, Fuel properties and CombustionStoichiometry.

UNIT II

Combustion in S.I. Engines: Fuel system components, Carburetor, Fuel Injection System, Ignition systems, Normal Combustion and abnormal combustion, Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking.

Fuel requirements and fuel rating, anti- knock additives, combustion chamber requirements, types.

Combustion in C.I. Engines: Four stages of combustion, Delay period and its importance, Effect of engine variables, Diesel Knock, need for air movement, suction, compression and combustion induced turbulence, open and divided combustion chambers and nozzles used, fuel requirements and fuel rating.

UNIT III

Testing and Performance: Parameters of performance, measurement of cylinder pressure,fuel consumption, air intake, exhaust gas composition.

Significance of Performance test: Determination of Brake power, frictional losses andindicated power, Air fuel ratio, thermal and Mechanical efficiencies

Heat balance sheet: Significance, losses due to exhaust gases, cooling systems and various ways, Chart of Heat balance

UNIT IV

Reciprocating and Rotary Compressors:

Compressors: Classification-positive displacement and roto dynamic machinery-Power producing and power absorbing machines, fan, blower and compressor-positive displacement and dynamic types-reciprocating and rotary types.

Reciprocating: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm Compressor, mechanical details and principle of working and efficiency considerations.

UNIT V

Dynamic and Axial Flow Compressors Dynamic Compressors:

Centrifugal compressors: Mechanical details and principle of operation, velocity and pressure variation, Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient, velocity diagrams, power.

Axial Flow Compressors: Mechanical details and principle of operation, velocity triangles and energy transfer per stage degree of reaction, work done factor, isentropic efficiency, Pressure rise calculations –Polytropic efficiency.

Text books:

1. I.C. Engines / V. Ganesan / Mc Graw Hill
2. Thermal Engineering / Mahesh M Rathore / Mc Graw Hill

Reference books:

1. Applied Thermodynamics for Engineering Technologists / Eastop / Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / WileyEastern
3. Internal Combustion Engines Fundamentals – John B. Heywood – McGraw Hill Ed

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FLUID MECHANICS AND FLUID MACHINES

CourseCode: GR20A2046 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. Explain the Concept and application of mass and momentum conservation laws for fluid flows
2. Understand the importance of dimensional analysis
3. Obtain the velocity and pressure variations in various types of simple flows
4. Analyze the flow in water pumps and turbines
5. Study and apply the Energy conservation laws for fluid flow applications

Course Outcomes:

1. Apply concept of mathematics, science and engineering in fluid flows
2. Use the governing equations of fluid flow and apply the same to simple flow problems
3. Explain the mathematical formulation of various flow problems.
4. Analyze the boundary layer concept to the fluid flow problems.
5. Execute the concept of fluid and models of fluids for flow problems.

UNIT I

Definition of fluid, Newton's law of viscosity, Units and dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.

UNIT II

Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli-concept of boundary layer– measures of boundary layer thickness–Darcy Weisbach equation, friction factor, Moody's diagram.

UNIT III

Need for dimensional analysis–methods of dimension analysis–Similitude–types of similitude Dimensionless parameters–application of dimensionless parameters–Model analysis.

UNIT IV

Euler's equation–theory of roto dynamic machines–various efficiencies–velocity components at entry and exit of the rotor, velocity triangles–Centrifugal pumps, working principle, work done by the impeller, performance curves–Cavitation in pumps-Reciprocating pump–working principle.

UNIT V

Classification of water turbines, heads and efficiencies, velocity triangles-Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles–draft tube-Specific speed, unit quantities, performance curves for turbines–governing of turbines.

Text/Reference Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Introduction to Fluid Mechanics and Fluid Machines By S K Som, Gautam Biswas, McGrawHill.
3. Fluid Mechanics and Hydraulic Machines by R K Rajput.
4. Fluid Mechanics and Hydraulic machines by R K Bansal, Laxmi publications.
5. Fluid Mechanics & Hydraulic Machines: Problems & Solutions by K.Subrmanya /TMH private limited.
6. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DYNAMICS OF MACHINERY

Course Code: GR20A2047 **L/T/P/C: 3/0/0/3**

II Year II Semester

Course Objectives:

1. Understand the concept of gyroscopic couple and its effect on aero plane, ship, two and four wheel drive.
2. Introduce the approaches and mathematical models used in static and dynamic analysis of machinery
3. Impart the knowledge of Various Governors, Brakes and operation of Dynamometers.
4. Understand the concepts of balancing of rotating masses and reciprocating masses.
5. Introduce of mathematical models and solution methods to study Vibration of the mechanical systems

Course Outcomes:

1. Analyze complete motion analysis of machines in running condition and able to know friction and its effect on mechanical efficiency.
2. Design various mechanisms of machines which were used in real life and explain how to get equilibrium condition of machine members while the machine is in running condition.
3. Apply the knowledge regarding use of turning moment diagram and energy fluctuations with in systems.
4. Explain how to balance forces and moments produced by rotating or reciprocating masses of machine members.
5. Analyze the vibrations, which is the major disturbance in machines while in the running condition and also precautions to reduce vibration.

UNIT I

Gyroscopes: Introduction, Precisional angular motion, Gyroscopic couple, effect of gyroscopic couple on an aeroplane, effect of gyroscopic couple on a naval ship during steering, gyroscopic couple on a naval ship during pitching, Gyroscopic couple on a naval ship during rolling, stability of a four wheel drive moving in a curved path, stability of a two wheel vehicle taking a turn.

UNIT II

Static Force Analysis: Introduction, Static Equilibrium, Equilibrium of Two-force and three force members, Member with Two force

Dynamic force Analysis: Introduction, D'Alemberts principle, Equivalent Offset inertia force, Dynamic analysis of Four bar and Single slider mechanisms, Piston effort, Turning moment on crank shaft, Inertia of connecting rod, Inertia forces in reciprocating Engines.

UNIT III

Governors: Introduction, types of governors, Watt governor, Porter governor, Proell governor, Hartnell governor, Wilson-Hartnell governor, Spring controlled gravity governor, Inertia governors, Sensitiveness of governor, Hunting, Isochronism, Stability, effort of governor, Power of governor, Controlling force.

Brakes and Dynamometers: Types of brakes: Simple block brake, band and block brake internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT IV

Balancing of Rotating Masses: Balancing of rotating masses in single and different planes.

Balancing of Reciprocating Masses: Primary, Secondary, and higher balancing of reciprocating masses, Analytical and graphical methods. Unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing–Hammer blow, Swaying couple, variation of tractive efforts.

UNIT V

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

Text books:

1. Theory of Machines / S.S Ratan/ Mc. GrawHill Publ.
2. Theory of machines/Khurmi/S.Chand.

References:

1. Theory of Machines by Thomas Bevan/ CBS
2. Theory of Machines / R.K Bansal
3. Theory of Machines Sadhu Singh Pearson's Edition
4. Theory of Machines /Shigley/ Oxford.
5. Theory of machines – PL. Balaney/khanna publishers.
6. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age

Teaching Methodology:

- Power point Presentations
- Working models
- white board & marker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROBABILITY AND STATISTICS

Course Code: GR20A2005 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. Interpret the measures of central tendency and dispersion.
2. Distinguish between explanatory and response variables and analyze data using correlation and regression.
3. Apply various probability distributions.
4. Apply tests of hypothesis.
5. Employ basic analysis of time series data.

Course Outcomes:

1. Compute and interpret descriptive statistics.
2. Evaluate random processes which occur in engineering applications governed by the Binomial, Poisson, Normal and Exponential distributions.
3. Fit the models using Regression Analysis.
4. Apply Inferential Statistics to make predictions or judgments about the population from which the sample data is drawn.
5. Interpret Time series data.

UNIT I
Random Variables, Basic Statistics, Correlation and Regression

Notion of Randomness, Random Experiment, Random variables – Discrete and Continuous, Probability mass function and density function, constants of r.v.s (Mean, Variance, Monents about mean), Concept of Bivariate distributions and Covariance.

Measures of central tendency and moments.

Correlation : Karl-Pearson's correlation coefficient and Spearman's Rank correlation, Statements of their properties and problems, Simple and Multiple Linear Regression (three variables case only), Statements of properties of Regression coefficients and problems.

UNIT II
Probability Distributions

Discrete Distributions: Binomial and Poisson distributions - definition, real life examples, Statements of their Mean and Variance, related problems, evaluation of statistical parameters.
Continuous Distributions: Normal, Exponential and Gamma distributions - definition, real life examples, Statements of their Mean and Variance and related problems, evaluation of statistical parameters for Normal distribution.

UNIT III
Testing of Hypothesis-1 (Large sample)

Concept of Sampling distribution and Standard error, tests for single proportion, difference of proportions, single mean, difference of means and Chi-square test for independence of attributes. Estimation of confidence interval for population mean and population proportions.

UNIT IV

Testing of Hypothesis-2 (Small Sample)

Tests for single mean, difference of means, Population variance, ratio of variances, ANOVA 1-way and 2-way. Estimation of confidence interval for Population mean.

UNIT V

Time Series analysis

Components of Time series, Additive and Multiplicative Decomposition of Time series components, Measuring trend by method of Moving averages, Straight line and Second degree parabola, Measuring seasonal variation by Ratio to Trend method and Ratio to Moving averages method.

Text / References:

1. S. C.Gupta&V.K.Kapoor, "Fundamentals of Mathematical Statistics", S.Chand.
2. Richard A.Johnson," Probability and Statistics for Engineers", Pearson Education.
3. Jay Devore, "Probability and Statistics for Engineering and the Sciences",Cengage learning.
4. Murat Kulahci,"Time series analysis and forecasting by example",John Wiley & Sons
5. S. C.Gupta&V.K.Kapoor, "Fundamentals of Applied Statistics", S.Chand.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MANUFACTURING PROCESS

Course Code:GR20A2048 **L/T/P/C: 2/1/0/3**
II Year II Semester

Prerequisites: Basic knowledge in engineering workshop practices
Course Objectives:

1. Impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting
2. Impart knowledge about process during welding and weldability aspects of different common engineering materials.
3. Impart knowledge about different forming processes and requirements for achieving good quality components.
4. Introduce the sheet metal forming techniques and its applications
5. Introduction to various plastic parts manufacturing methods used.

Course Outcomes:

1. Impart knowledge on role and value of production and identify basic production processes.
2. Introduction to methods of joining that shows a comprehensive understanding of tools, materials, equipment, and processes.
3. Apply critical thinking skills for development and evaluating sheet metal forming processes.
4. Identify and use the materials, tools, machines, and techniques used in variousforming processes.
5. Demonstrate various ways of producing plastic products and its equipment details.

UNIT I
Metal Casting Processes: Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process– Sand Casting defects – Inspection methods.

UNIT II
Joining Processes: Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG and MIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding –Friction welding – Diffusion welding – Weld defects – Brazing and soldering process –Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III

Bulk Deforming Processes: Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the process – Types of Forging Machines –Typical forging operations – Rolling of metals – Types of Rolling mills - Flat strip rolling– Shape rolling operations – Defects in rolled parts - Principle of rod and wire drawing -Tube drawing — Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion— Equipments used.

UNIT IV

Sheet Metal Processes: Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations — Formability of sheet metal – Test methods– Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

UNIT V

Manufacturing of Plastic Components: Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding –Plunger and screw machines – Compression moulding, Transfer moulding – Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion - Thermoforming, - Bonding of Thermoplastics.

Text books:

1. Hajra Choudhury, “Elements of Workshop Technology,Vol. I and II”, MediaPromotors Pvt Ltd., Mumbai, 2001
2. S.Gowri, P.Hariharan, and A.SureshBabu, “Manufacturing Technology 1”, PearsonEducation , 2008.
3. P.N. Rao,”ManufacturingTechnology”,Tata McGraw-Hill Publishing Limited,II Edition, 2002.

Reference books:

1. B.S. MagendranParashar& R.K. Mittal,”Elements of Manufacturing Processes”,Prentice Hall of India, 2003.
2. P.C. Sharma, “A text book of production technology”,S. Chand and Company, IVEdition, 2003.
3. Begman, ‘Manufacturing Process”, John Wilely& Sons, VIII Edition, 2005.
4. SeropeKalpajian,Steven R.Schmid, Manufacturing Engineering andTechnology, Pearson Education, Inc. 2002(Second Indian Reprint).
5. Beddoes.J and Bibby M.J, ‘Principles of Metal Manufacturing Processes’, Elsevier, 2006.
6. Rajput R.K, ‘A text book of Manufacturing Technology’, Lakshmi Publications, 2007.

Teaching Methodology:

- Power point Presentations
- Working models
- white board & marker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
THERMAL ENGINEERING LAB

CourseCode:GR20A2049 **L/T/P/C: 0/0/4/2**
II Year II Semester

Course Objectives:

1. Understand the working principles of each component of internal combustion engines, refrigeration system, Boilers etc.
2. Explore to measuring devices functioning for air, fuel, temperature, pressure, loading,speed, Calorific value, viscosity etc.
3. Recollect the basic conservation of energy principles, laws of thermodynamics for realtime applications.
4. Explain the process involved in the thermal systems for assessing the performance andits enhancement using graphs, balance sheets etc.
5. Summarize the differences between internal and external combustionengines, reciprocating and rotary type with merits and limitations.

Course Outcomes:

1. Explain the functioning of measuring devices such as manometer, thermocouples, loading devices, fuel measurements etc. by applying the conservation laws and demonstrate the function of parts of 4 stroke diesel/petrol engines by assembling and dismantling.
2. Evaluate the properties of fuels such as flash & fire points, calorific value, Viscosity using basic concepts by conducting experimentation.
3. Assess the performance parameters of different thermal systems such as diesel/Petrol engines, refrigeration system, air compressors, Boilers etc.,
4. Enumerate and calculate the amount of dissipation of heat/energy in different ways by drawing balance sheets for an IC Engine.
5. Represent the processes, performance of the system in the form of graphs, period of suction, compression, expansion, exhaust and injection/ignition in the form of diagrams.

LIST OF EXPERIMENTS:

Task-1: Disassemble and Assemble of 4 stroke single cylinder diesel and petrol engine
Task-2: Valve timing diagram for 4 stroke single cylinder diesel and petrol engine
Task-3: Performance test on 4-stroke single cylinder diesel engine with Electrical loading
Task-4: Heat balance test on 4 stroke single cylinder diesel engine with Electrical loading
Task-5: Performance test on 4- stroke single cylinder diesel engine with Mechanical loading
Task-6: Heat balance test on 4-stroke single cylinder diesel engine with Mechanical loading
Task-7: Determination of the calorific value of a given fuel
Task-8: Determination of the flash & fire points of a given fuel
Task-9: Determination of the density and viscosity of a given oil
Task-10: Performance test on two stage reciprocating Air Compressor
Task-11: Study of Babcock and Wilcox boiler
Task-12: Determination of COP of a Vapour compression refrigeration system

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MANUFACTURING PROCESS LAB

Course Code: GR20A2050 **L/T/P/C: 0/0/3/1.5**
II Year II Semester

Prerequisites: Fundamentals of Production of Technology

Course Objectives:
1. Provide practical experience in various welding processes with different materials.
2. Give knowledge and practical exposure on how to form plastic formation by using plastic moulding machine.
3. Impart Knowledge in casting process with various types of tools.
4. Know various welding processes.
5. Impart knowledge on various production processes in manufacturing a product.

Course Outcomes:
1. Design and manufacture simple patterns for castings.
2. Knowledge on different kinds of joining processes.
3. Manufacture plastic components.
4. Knowledge on different kinds of production processes available for shaping ormoulding several daily used components.
5. Recognize the importance of safety devices and gain practical experience on various manufacturing processes.

Task-1: CASTING
1. Pattern Design and making-2 Exercises.
2. Moulding, Melting and Casting-1Exercise

Task-2: WELDING
1. ARC Welding Lap Joint-1 Exercise
2. ARC Welding Butt Joint-1 Exercise
3. Spot Welding-1Exercise
4. TIGWelding-1Exercise
5. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

Task-3: MECHANICAL PRESS WORKING
1. Blanking & Piercing operation and study of simple, compound and progressive presstool.
2. Hydraulic Press: Deep drawing.
3. Bending and other operation

Task-4: PROCESSING OF PLASTICS
1. Injection Moulding
2. Blow Moulding

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FLUID MECHANICS AND FLUID MACHINES LAB

CourseCode:GR20A2051 **L/T/P/C: 0/0/3/1.5**
II Year II Semester

Prerequisites: Fundamentals of Fluid Mechanics and Fluid Machinery
Course Objectives:
1. Provide practical knowledge in verification of principles of fluid flow.
2. Impart knowledge in measuring pressure, discharge and velocity of fluid flow.
3. Understand Major and Minor Losses.
4. Gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.
5. Familiarize laminar and turbulent flows in pipes.

Course Outcomes:
1. Demonstrate practical knowledge in fluid flow principles.
2. Demonstrate the knowledge in calculating performance analysis in turbines and pumps understand to analyse practical problems in all power plants and chemical industries.
3. Conduct experiments in pipe flows and interpreting data from model studies toprototype cases, as well as documenting them in engineering reports.
4. Analyse a variety of fluid-flow devices and utilize fluid mechanics principles in design.
5. Analyze flow rate and pressure rise, select the proper pump to optimize the pumping efficiency.

LIST OF EXPERIMENTS:
Task-1: Verification of Bernoulli's theorem and draw the HGL, TEL
Task-2: Determination of Coefficient discharge of Venturi meter and Orificemeter.
Task-3: Determination of Darcy's Friction factor in various diameters of pipes
Task-4: Determination of Minor Losses (Different Valve connections, SuddenExpansion, Sudden Contraction, Bends, joints) in various pipe fittings
Task-5: Determination of coefficient of impact of Jet on given Vanes
Task-6: Determination of overall efficiency of Pelton wheel Turbine at ConstantSpeed and Constant Head
Task-7: Determination of overall efficiency of Francis Turbine at Constant Speedand Constant Head
Task-8: Determination of overall efficiency of Kaplan Turbine at Constant Speedand Constant Head
Task-9: Determination of the overall efficiency of Single Stage Centrifugal pump
Task-10: Determination of the overall efficiency of Multistage Centrifugal pump
Task-11: Determination of the overall efficiency of Reciprocating pump
Task-12: Determination of the laminar and turbulent flow using Reynold's apparatus.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONSTITUTION OF INDIA

Course Code:GR20A2003 **L/T/P/C: 2/0/0/2**
II Year II Semester

Course Objectives:

1. Create an awareness about the Constitution of India, Fundamental Rights and Duties, DirectivePrinciples.
2. Learn the role of Prime Minister, President and the Council of Ministers and the State Legislature.
3. Learn the divisions of executive, legislative and judiciary and so on.
4. Know how a municipal office, panchayat office etc. works.
5. Understand the importance and role of Election Commission Functions.

Course Outcomes:

1. Know the importance of Constitution and Government.
2. Become Good Citizens and know their fundamental rights, duties and principles.
3. Learn about the role of PM, President, Council of Ministers and Local Administration.
4. Understand the importance of Election Commission.
5. Know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Statusof States etc.,

UNIT I

Introduction: 'Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II

Union Government and its Administration: Structure of the Indian Union: Federalism, Centre - State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

UNIT III

State Government and its Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions.

UNIT IV

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

UNIT V

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.

Text/Reference Books:

1.'Indian Polity' by Laxmikanth 5th Edition, McGraw Hill Edition.
2.Indian Constitution by Subhash C. Kashyap, Vision Books Publisher
3.'Introduction to Indian Constitution' by D.D. Basu, 21st Edition, LexisNexis Publisher
4.'Indian Administration by avasthi and avasthi-by lakshminarain agarwal publication

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATABASE FOR ENGINEERS

Course Code: GR20A2006 **L/T/P/C: 2/0/0/2**
II Year II Semester

Course Objectives:

1. To understand the different issues involved in the design and implementation of adatabase system.
2. To understand Structured Query Language for manipulating the Data.
3. To study the physical, conceptual and logical database designs
4. To provide concepts of Transaction, Concurrency and Recovery ManagementStrategies of a DBMS
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.

Course Outcomes:

1. Identify the role of Database System Applications and the design issues related.
2. Design the logical model for the applications and apply indexing techniques.
3. Construct a Database Schema, Manipulate data using a SQL.
4. Can apply the Schema Refinement techniques for a database design for optimizedaccess.
5. For a given transaction-processing system, determine the transaction atomicity, consistency,
   isolation, and durability.

UNIT I

Introduction to DBMS, Data Base System Applications, Data Base System VS File System, Instances And Schemas, Data Models – The ER Model, ER Diagrams –Attributes And Entity Sets – RelationshipsAnd Relationship Sets – Concept Design With The ER Model .

To Practice:

1) Practicing DDL commands: Creating tables for various relations (in SQL).
2) Practicing Hostel Management System ER Diagram, Airlines Reservation System ER Diagram.

UNIT II

Relational Model: Introduction To The Relational Model – Basic Structure, Database Schema, Keys, Form Of Basic SQL Query – Database Langugages , DDL , DML , Examples Of Basic SQL Queries .

To Practice:

Practicing SQL Queries of above mentioned topics

UNIT III

SQLoperators,SQL functions, JOINS, -Types of Joins,Introduction To Nested Queries, Set Operators,Integrity Constraints over relations,Introduction to Views , Destroying / altering tables and views.Practice on DCL and TCL commands.

To Practice:

Practicing SQL Queries of above mentioned topics

UNIT IV

Pitfalls in relational databases,Functional Dependencies ,Importance of Normalization– 1NF,2NF,3NF,BCNF,4NF

To Practice:

Concepts of Normalizations and its types, Writing Assertions.

UNIT V

Transaction Concept- Transaction state,ACID properties, Concurrent executions,Serializability, Lockbased protocols,Log based recovery.

To Practice:

Practicing, DCL and TCL commands,(Commit, rollback, Save points, Grant, Revoke and Rolescommands on tables)

TEXT BOOK:

1. "Data base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATAMcGraw Hill 3rdEdition

REFERENCE BOOKS:

1. "Data base System Concepts", Silberschatz, Korth, McGraw hill, V edition.
2. "Introduction to Database Systems", C.J.Date Pearson Education.
3. "Database Systems design, Implementation, and Management", Rob & Coronel 5th Edition.
4. "Database Management Systems", P. Radha Krishna HI-TECH Publications 2005.
5. "Database Management System", ElmasriNavate Pearson Education.
6. "Database Management System", Mathew Leon, Leo.

III YEAR

I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MACHINE DESIGN

Course Code: GR20A3023 **L/T/P/C: 2/1/0/3**

III Year I Semester

Course Objectives:

1. Understand the design procedures for finding out the various dimensions of machineparts.
2. An appreciation of the relationships between component level design and overallmachine system design and performance.
3. Analyze design procedure to find the dimensions of riveted joints.
4. Apply the design procedure to find the dimensions of key, cotters and Knuckle joints.
5. Employ the design procedure to find dimensions of shafts subjected to combinedloading.

Course Outcomes:

1. Compute the dimensions of the members subjected to bi-axial loading using theoriesof failure.
2. Design the machine members subjected to simple stresses and fatigue loading.
3. Solve the dimensions of the riveted, welded and bolted joints subjected differentloading.
4. Design of keys, cotters and knuckle joints subjected to tensile and compressiveloading.
5. Compute the dimensions of the shafts and shaft couplings subjected to torsionalloading, combined torsional and bending loading.

UNIT I

Introduction: General considerations in design, Engineering Materials and their properties – Selection of Materials –Manufacturing consideration in design. Tolerances and fits. Simple stresses
– Various theories of failure.

UNIT II

Strength of Machine Elements: Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor-notch sensitivity – Endurance limit – Design of members subjected to variable loading –Estimation of Endurance strength – Gerber's parabola, Goodman's line – Soderberg's line

UNIT III

Bolted joints: Design of bolts with pre-stresses – Design of joints under eccentric loading.

Riveted and Welded Joints: Design of joints with initial stresses – eccentric loading.

UNIT IV

Keys, Cotters and Knuckle Joints: Design of Keys-stresses in keys- Cotter joints-Spigot and Socket, Sleeve and Cotter, Gib and Cotter joints-Knuckle joints.

UNIT V

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined,axial, bending and torsional loads – Shaft sizes – BIS codes.

Shaft Couplings: Rigid couplings – Muff, Split Muff and Flange couplings. Flexible couplings-Bushed pin type coupling–Universal coupling-Oldham's coupling.

Text books:

1. Machine Design – R.S.Khurmi and J K Gupta
2. Design of Machine Elements Design, V. B. Bandari -TMH Publishers
3. Machine Design – Pandya and Shah.

References:

1. Machine Design / Schaum Series
2. Machine Design by Shigley, MH Publishers
3. Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.
4. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ECONOMICS AND ACCOUNTING FOR ENGINEERS

Course Code: GR20A2004 **L/T/P/C:3/0/0/3**
III Year I Semester

Course Objectives:

1. To provide the student with a clear understanding of demand analysis, elasticity of demand and demand forecasting;
2. To provide the insight on theory of production and cost analysis.
3. To describe different types of markets and competition, forms of organization and methods ofpricing.
4. To make the students understand various capital budgeting techniques.
5. To describe fundamentals of accounting.

Course Outcomes:

1. Scan the economic environment and forecast demand of products through demand forecasting techniques.
2. Plan the production levels in tune with maximum utilization of organizational resources and with maximum profitability and list out various costs associated with production and able to compute breakeven point.
3. Outline the different types markets and competition, forms of business organization and methods of pricing.
4. Analyze the profitability of various projects using capital budgeting techniques
5. Prepare the financial statements.

UNIT I

Introduction and Demand Analysis: Definition and Scope: Introduction to Economics, Nature and Scope of Managerial Economics. **Demand Analysis**: Demand Determinants, Law of Demand and its exceptions. **Elasticity of Demand**: Definition, Types, Measurement and Significance of Elasticity of Demand. **Demand Forecasting**, Factors governing demand forecasting, methods of demand forecasting.

UNIT II

Production and Cost Analysis: Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Laws of Returns, Internal and External Economies of Scale. **Cost Analysis:** Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT III

Markets and Forms of Business organizations: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. **Pricing:** Objectives and Policies of Pricing. Methods of Pricing. **Business:** Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types.

UNIT IV

Capital Budgeting: Capital and its significance, Types of Capital, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value (NPV) Method and Internal Rate of Return (IRR) (simple problems) and Profitability Index (PI)

UNIT V

Introduction to Financial Accounting: Accounting Concepts and Conventions - Double-Entry Book Keeping. **Accounting Cycle:** Journal, Ledger, Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Text Books

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.
2. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher,Sultan Chand, 2007.
3. Financial Accounting -1: S P Jain and K. L. Narang, Kalyani Publishers,2005.

Reference Books

1. Peterson, Lewis and Jain: Managerial Economics, Pearson, 2009
2. Mithani : Managerial Economics , HPH, 2009
3. Lipsey and Chrystel, Economics, Oxford University Press, 2009
4. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2009
5. Horngren : Financial Accounting, Pearson, 2009.
6. Dr. S. N. Maheswari and Dr. S.K. Maheshwari: Financial Accounting, Vikas, 2009.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MANUFACTURING TECHNOLOGY

Course Code: GR20A3024 **L/T/P/C:3/0/0/3**
III Year I Semester

Course Objectives:

1. Acquire the knowledge on cutting tool geometry, mechanism of metal cutting process.
2. Provide knowledge on Lathe machines and related tools for manufacturing variouscomponents.
3. Impart the fundamental aspects of the reciprocating machine's principles and theirapplication in various machining processes.
4. Train in knowing the fundamental parts of various surface finishing machine toolswhich is having increasing importance in industry.
5. Discuss various principles of jigs and fixtures which will be used hold the workpiecesin various machine tools.

Course Outcomes:

1. Explain the importance of tool geometry in manufacturing the component.
2. Operate Lathe machines commonly found in industry including manual and computer controlled lathes.
3. Perform various operations on reciprocating metal cutting machines.
4. Execute different milling operations on various milling machines.
5. Understand various finishing process on various machines.

UNIT I

Metal Cutting: Elementary treatment of metal cutting theory– Elements of cutting process – Geometry of single point tool and angles- chip formation and types of chips– built up edge and its effects chip breakers.- Mechanics of orthogonal cutting– Merchant's Force diagram, cutting forces– tool life equation, cutting fluids, machinability– MRR- Tool materials.

UNIT II

Lathe Machines: working principle, specification of lathe – types of lathe – work piece holders, tool holders –Taper turning methods - thread cutting – Lathe attachments. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes, CNC lathes.

UNIT III

Shaping, slotting and planning machines: Principles of working – Principal parts – specification classification, operations performed. Kinematic scheme of the shaping,
slotting and planning machines- machining time calculations.
Drilling and Boring Machines: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine - Deep hole drilling machine.

UNIT IV

Milling machine: working principle – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines, Types geometry of milling cutter – milling cutters – Various milling operations – Accessories of milling machines, kinematic scheme of milling cutters .

UNIT V

Grinding machines: Fundamentals of grinding– Theory of grinding– classification of grinding machines– cylindrical and surface grinding machine – Tool and cutter grinding machine– Special types of grinding machines– Different types of abrasives– bonds specification of a grinding wheel and selection of a grinding wheel- Kinematic scheme of grinding machines.

Lapping, honing and broaching machines: Comparison to grinding – lapping and honing-broaching machines-Principles of working – Principal parts – specification- classification, operations performed.

Jigs and Fixtures: Design principles of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and fixtures.

Text books:

1. Production Technology by R.K. Jain and S.C. Gupta.
2. Workshop Technology – B.S.RaghuVamshi – Vol II.

References:

1. Machine Tools – C.Elanchezhian and M. Vijayan / Anuradha Agencies Publishers.
2. Production Technology by H.M.T. (Hindustan Machine Tools).
3. Metal Cutting by Juneja

Teaching Methodology:

- Power point Presentations
- Working models
- white board & marker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
APPLIED THERMODYNAMICS

Course Code: GR20A3025 **L/T/P/C: 2/0/0/2**
III Year I Semester

Course Objectives:

1. Understand different components of steam power plant and its working principle with performance improvement methods of performance
2. Explain the working principle of accessories and mountings of the boiler and their performance
3. Classify the different types of nozzles and condensers and its applications in real time environment
4. Discuss the classification of steam turbines and its thermodynamic analysis foreffective performance
5. Elaborate the working principle of jet propulsive devices and rocket engines based onbasic gas turbine cycle and their applications in real time

Course Outcomes:

1. Develop state – space diagrams based on the schematic diagrams of process flow ofsteam and gas turbine plants
2. Apply the laws of Thermodynamics to analyze thermodynamic cycles
3. Differentiate between Vapour power cycles and gas power cycles for steam and gasturbine plants and their functionality
4. Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plant
5. Understand the functionality of major components of steam and gas turbine plants andto do the analysis on the working of various propulsive devices

UNIT I

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration and Reheating.

Fuels and Combustion : Fuel - Types – Calorific values (Heating value) of fuels - Bomb calorimeter - Junker's Gas calorimeter– Definition of combustion of fuel -Calculation of minimum air required(on mass basis) for the complete combustion of fuel having a given composition – Products of combustion- Orsat Apparatus for flue gas analysis.

UNIT II

Boilers: Classification – Working principles with sketches including H.P. Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance – Draught- Classification – Height of chimney for given draught and discharge- Condition for maximum discharge- Efficiency of chimney **Steam Nozzles:** Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge-
Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

UNIT III

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed-Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction –Velocity diagram – Parson's reaction turbine – Condition for maximum efficiency

UNIT IV

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Working principle of different types – Vacuum efficiency and Condenser efficiency – Air leakage, sources and its affects, Air pump- Cooling water requirement.

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Actual cycle – Regeneration, Inter cooling and Reheating –Closed and Semi-closed cycles – Merits and Demerits- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT V

Jet Propulsion: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

Text books:

1. Thermal Engineering/ Rajput/ Lakshmi Publications
2. Applied Thermodynamics P.K Nag, Mc Graw Hill
3. Thermal Engineering / Mahesh M Rathore/ Mc Graw Hill
4. Gas Turbines – V. Ganesan /Mc Graw Hill

Reference books:

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/ Pearson
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/ PHI

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
METROLOGY AND SURFACE ENGINEERING
(PROFESSIONAL ELECTIVE - I)

Course Code: GR20A3026 **L/T/P/C: 3/0/0/3**

III Year I Semester

Course Objectives:

1. Provide a basic understanding of the wide range of activities encompassed by personnel working in standards and calibration laboratories.
2. Measure length and angles using line-graduated instruments, i.e. vernier calipers, micrometers, bevel protractor, sine bar and use comparative length-measuring instruments, i.e. dial indicator, to measure variations in the distance between two or more surfaces.
3. Measure straightness, flatness, roundness, profile, screw threads and gear teeth
4. Develop in production and manufacturing fields to lead the industrial organizations.
5. Introduce the measurement process, types and correct use of measurement and test equipment, and measurement standards.

Course Outcomes:

1. Identify the uncertainties in dimensional metrology and define the measurement standards and describe the fundamentals of dimensional and geometrical tolerances.
2. Measure lengths and angles using line-graduated instruments, i.e., vernier calipers, micrometers, bevel protractor, sine bar and surface plates and use comparative length-measuring instruments, i.e. dial indicator, comparator to measure variations in the distance between two or more surfaces.
3. Operate optical measuring instruments like contour projector, tool makers microscope and demonstrate coordinate measuring machine to record measurements of complex profiles with high sensitivity.
4. Explain the effect of surface roughness and demonstrate the surface roughness measurement methods for improving the quality
5. Use effective methods of measuring straightness, flatness, roundness, surface profile, screw threads, gear teeth and alignment tests on milling, lathe and drilling machine.

UNIT I

Systems of limits and fits: Introduction, normal size, tolerance, limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – British standard system, International Standard system for plain and screwed work.

UNIT II

Linear measurement: Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

Measurement of angles and tapers: Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

LIMIT GAUGES: Taylor's principle – Design of Go and No Go gauges, plug ring, snap, gap, taper, profile and position gauges.

UNIT III

Optical measuring instruments: Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.

Flat surface measurement: Measurement of flat surfaces – instruments used – straight edges – surface plates – optical flat and auto collimator.

UNIT IV

Surface roughness measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S Values – Rz values, Methods of measurement of surface finish-profilograph, Talysurf, ISI symbols for indication of surface finish.

Measurement through comparators: Comparators – Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

UNIT V

Screw thread measurement: Element of measurement – errors in screw threads –measurement of effective diameter, angle of thread and thread pitch, profile thread gauges. **Machine tool alignment tests:** Requirements of Machine Tool Alignment Tests,Alignment tests on lathe, milling, drilling machine tools.. Preparation of acceptance charts. **Gear measurement:** Gear measuring instruments, Gear tooth profile measurement.Measurement of diameter, pitch pressure angle and tooth thickness.

Coordinate Measuring Machines: Types of CMM, Role of CMM, and Applications of CMM.

Text books:

1. Engineering Metrology / I C Gupta./Danpath Rai
2. Engineering Metrology / R.K. Jain / Khanna Publishers

References:

1. BIS standards on Limits AND Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology 4e / Connie Dotson / Thomson
3. Handbook of Tribology: Materials, Coating, and Surface Treatments/ Bharat Bhushanand B.K.Gupta.
4. Surface Engineering with Lasers/ Dehosson J.T.
5. Surface Engineering for corrosion and wear resistance / JR Davis/ WoodheadPublishers.

Teaching Methodology:

- Power point Presentations
- Working models
- white board and marker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS
(PROFESSIONAL ELECTIVE- I)

Course Code: GR20A3027 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Objectives:

1. Apply fundamental 'principle stress' concept and determine stresses, strains anddeformations when thin or thick pressure vessels subjected to internal fluid pressure.
2. Classify statically indeterminate structures and use various energy methods.
3. Interpret and compare continuous beam with fixed beams and sketch shear force andresultant bending moment diagrams
4. Choose appropriate theorem to compute critical loads and stresses in the analysis ofcolumns.
5. Develop necessary formulae to calculate stresses in rotating discs and curved beams.

Course Outcomes:

1. Calculate principle stresses in thin and thick pressure vessels.
2. Solve for stresses and deflections of fixed beams under different loading conditions.
3. Compute reactions and support moments in continuous beams.
4. Obtain solutions to column buckling and plate problems.
5. Analyze stresses in curved beams and rotating discs.

UNIT I

Thin Cylinders and Spherical Shells: Stresses and strains in thin cylinders, thin spherical shell. Thick cylinders: Thick cylinders subjected to internal and external pressure and compound cylinders.

UNIT II

Fixed Beams: Fixing moments and Reactions for a fixed beam of uniform section, Effect of sinking support, slope and deflection. Construction of shear force and bending moment diagrams.

UNIT III

Continuous Beams: Reaction at the supports, and support moments Effect of sinking of supports.

UNIT IV

Columns and Struts: Columns with one end free and the other fixed, Both ends fixed, One end fixed and other hinged, Limitation of Euler's formula, Rankine's Formula, Column with initial curvature, Column carrying eccentric load, Laterally loaded columns.

UNIT V

Bending of Curved Beams: Stresses in bars of circular, rectangular and Trapezoidal sections.Stresses due to rotation: Wheel rim, disc of uniform thickness, disc of uniform strength.

Text Books:

1. Strength of materials by Dr. Sadhu Singh, Khanna Publishers
2. Strength of Materials by R.K .Rajput
3. G. T. Mase, R. E. Smelser and G. E. Mase, Continuum Mechanics for Engineers,Third Edition, CRC Press, 2004.
4. Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International, 1965.
5. Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, PrenticeHall international, 1969.

References:

1. Analysis of Structures, Vol. 1, 1993 edition, by Vazirani and Ratwani.
2. Mechanics of solids by Crandal, Dahl and Lardner.
3. Theory of structures by S.Ramamrutham and R. Narayan, Dhanpat Rai Publishers.

Teaching Methodology:

- Power point Presentations
- Working models
- White board and marker.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUTOMOBILE ENGINEERING
(PROFESSIONAL ELECTIVE – I)

Course Code: GR20A3028 **L/T/P/C: 3/0/0/3**

III Year I Semester

Course Objectives:

1. Introduction to various systems in automobile and their function for effective parameters
2. Explain the components of engine, fuel system, lubrication system, electrical system and importance of their effective designs
3. Illustrate the working of transmission system and its components such as clutch, gear box, propeller shaft and differential of the automobile
4. Discuss the particulates of combustion in CI and SI engines, reasons for formation of particulates and methods adopted to control the pollution
5. Elaborate the function of each accessories of steering, suspension and braking system and their role for effective performance of automobile relevant to performance and emission

Course Outcomes:

1. Illustrate the function of each and every component of an automobile. As well as ableto analyze the reasons for performance parameters
2. Demonstrate about emission standards, emission control techniques and electricalsystems. Student can identify thrust areas for carrying their dissertation in future.
3. Describe each component of transmission system of an automobile viz clutch, gearbox, propeller shaft and differential
4. Analyze the geometry of the steering mechanism and the effect of the same on tyre performance and other components of an automobile
5. List the different types of suspension system and braking system of an automobile and importance of each type based on real time applications

UNIT I

Introduction, Engine and Lubrication systems: Components of four wheeler automobile – chassis and body – power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, Engine construction, turbo charging and super charging, Engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, re-boring, decarburization, Nitriding of crank shaft.

UNIT II

Fuel System in S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters– carburetor – types – air filters – petrol injection-Multi point fuel injection(MPFI).

Fuel System in C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. CRDI engines, cooling systems.

Emissions: Emission from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Energy alternatives – Photovoltaic, hydrogen, Biomass, alcohols, LPG and CNG.

UNIT III

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and sparkplug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT IV

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles –types – wheels and tyres.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism–Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT V

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel Cylinder, tandem master cylinder, Requirement of brake fluid, Pneumatic and vacuum brakes.

Introduction and concept of Electrical Vehicles.

Text books:

1. Automobile Engineering -R B Gupta
2. Automotive Mechanics – William Crouse
3. Automobile Engineering Vol. 1 AND Vol. 2 / Kripal Singh

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTELLIGENT MANUFACTURING SYSTEMS
(PROFESSIONAL ELECTIVE- I)

Course Code: GR20A3029 **L/T/P/C:3/0/0/3**
III Year I Semester

Prerequisites: Computer Aided Manufacturing
Course Objectives:

1. Planning manufacturing systems
2. Computer integrated manufacturing and enterprise integration
3. Group Technology
4. Knowledge based systems
5. Application to machine to think as human.

Course Outcomes:

1. Assess the performance of manufacturing systems
2. Develop a systematic approach for design and implementation of manufacturingsystems
3. Suggest new procedures to improve the productivity of existing manufacturingsystems
4. Utilize online collaboration tools to work in complex teams.
5. Apply skills to change machine as smart machine which thinks.

UNIT I

Computer integrated manufacturing systems – structure and functional areas of CIM system - AD, CAPP, CAM, CAQC, ASRS and advantages of CIM Manufacturing communication systems – MAP/TOP OSI model, data redundancy, top-down and bottom- up approach, volume of information. Intelligent manufacturing–system components, system architecture and data flow, system operation.

UNIT II

Components of knowledge based systems – basic components of knowledge based systems, knowledge representation, comparison of knowledge representation schemes, interference engine, knowledge acquisition. Machine learning – concept of artificial intelligence, conceptual learning, artificial neural networks -biological neuron, artificial neuron, types of neural networks, applications in manufacturing

UNIT III

Automated process planning – variant approach, generative approach, expert systems for process planning, feature recognition, phases of process planning Knowledge Based

System for Equipment Selection (KBSES) – Manufacturing system design, equipment selection problem, modeling.

the manufacturing equipment selection problem, problem solving approach in KBSES, structure of the KBSES

UNIT IV

Group technology: models and algorithms – visual method, coding method, cluster analysis method, matrix formation – similarity coefficient method, sorting-based algorithms, bond energy algorithm, cost based method, cluster identification method, extended ci method.

UNIT V

Knowledge based group technology - group technology in automated manufacturing system, structure of knowledge based system for group technology (KBSGT) – data base, knowledge base, clustering algorithm.

Text books:

1. Mikell P. Groover, "Automation, Production Systems and Computer
2. Integrated Manufacturing", 8th edition, PHI, 2008.
3. Yagna Narayana, "Artificial Neural Networks", PHI, 2009.

References:

1. Andre Kusaic, " Intelligent Manufacturing Systems", PHI,1989
2. Hamid R. Parsaei and Mohammad Jamshidi, "Design and
3. Implementation of Intelligent Manufacturing Systems", PHI, 2009

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ROBOTICS

(OPEN ELECTIVE I)

Course Code: GR20A3030 **L/T/P/C: 3/0/0/3**

III Year I Semester

Course Objectives:

1. Introduce the automation and brief history of robot and applications.
2. Impart knowledge of familiarities with the kinematics of robots.
3. Develop knowledge about robot end effectors and their design.
4. Develop an ability on Robot Programming methods AND Languages of robot.
5. Impart knowledge about various Sensors and their applications in robots.

Course Outcomes:

1. Be familiarized with the Robot Anatomy and Robot Configurations
2. Create the automation and Robot applications.
3. Apply the kinematic motions of robot and knowledge about robot end effectors.
4. Integrate the Programming methods AND various Languages of robots.
5. Select appropriate Sensors and their applications in robots

UNIT I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and controlsystem.

UNIT II

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT III

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT IV

Differential transformation and manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages.

UNIT V

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric and stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading-Processing - spot and continuous arc welding AND spray painting - Assembly and Inspection.

Text books:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K and Nagrath I J / TMH.

References:

1. Robotics / Fu K S/ McGraw Hill.
2. An Introduction to Robot Technology, / P. Coiffet and M. Chaironze / Kogam Page Ltd. 1983 London.
3. Robotic Engineering / Richard D. Klafter, Prentice Hall
4. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science.
5. Introduction to Robotics / John J Craig / Pearson Edu.
6. Robot Dynamics and Control – Mark W. Spong and M. Vidyasagar / John Wiley and Sons (ASIA) Pte Ltd.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MANUFACTURING TECHNOLOGY LAB

Course Code: GR20A3031 **L/T/P/C: 0/0/3/1.5**
III Year I Semester

Course Objectives:
1. Inculcate the knowledge of tool geometry in manufacturing
2. Use the basic machine tools like computer controlled lathes, milling machines, drillpress and cutting machines
3. Impart knowledge about cutting forces and chip formation in metal cutting
4. Impart knowledge about select the gear cutting processes.
5. Inculcate the principles of safety and economics in machining process

Course Outcomes:
1. Apply tool geometry in manufacturing the component.
2. Operate machine tool equipment commonly found in industry including manual and computer controlled lathes, milling machines, drill presses and cutting machines
3. Perform chip formation analysis of metal cutting machines
4. Execute the finishing process on various machines
5. Apply safety principles in a work environment to minimize hazards and prevent lossesto productivity

List of Experiments
1. Preparation of Work specimen for lathe, drilling, shaping, slotting and milling
2. Plane & Step Turning operation on lathe Machine
3. Taper Turning on Lathe Machine
4. Thread cutting operation on-lathe machine.
5. Knurling operation on-lathe machine.
6. Drilling operation and boring operation on lathe machine
7. Drilling and counter boring operation on lathe machine
8. Drilling and internal thread cutting using Tapping
9. Edge preparation using Shaping machine
10. Key way cutting operation in Slotting machine
11. Face milling operation using Milling machine
12. Grinding of tool angles using Cylindrical /Surface Grinding Machine

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
METROLOGY LAB

Course Code: GR20A3032 **L/T/P/C:0/0/3/1.5**
III Year I Semester

Course Objectives:

1. Get an idea of the dimensional and form accuracy of products.
2. Identify and use reference materials, to ensure good quality, accurate, traceable measurement results.
3. Explain highlights and key concepts of each topic to each other and to your managers and show how these topics fit into a management system like ISO/IEC 17025.
4. Recognize various national and international organizations from which we get many of our metrology references, resources, and standards.
5. Apply dimensional analysis concepts correctly by looking up reference values for unit conversions, accurately perform associated mathematics, and present final values with the correct units/symbols.

Course Outcomes:

1. Evaluate the accuracy and tolerance of components produced and to define the measurement standards
2. Measure lengths, diameters and angles using line-graduated instruments, i. e. verniercalipers, micrometers, bevel protractor, sine bar and surface plates
3. Use comparative length-measuring instruments, i.e. dial indicator, to measure variations in the distance between two or more surfaces.
4. Use effective methods of measuring straightness, flatness, roundness, profile, screwthreads and gear teeth.
5. Use contour projector and coordinate measuring machine to record measurements ofcomplex profiles with high sensitivity.

List of Experiments:

1. Measurement of lengths, heights, diameters by vernier callipers and vernier heightgauge.
2. Measurement of internal, external diameters using internal and external micrometres.
3. Measurement of bores by internal micrometers and dial bore indicators.
4. Using gear tooth Vernier calipers and checking the chordal addendum and chordalheight of spur gear.
5. Machine tool alignment of test on the lathe.
6. Machine tool alignment test on milling machine.
7. Tool maker’s microscope and its application
8. Angle measurement by Bevel protractor, Sine bars.
9. Use of spirit level in finding the flatness of surface plate.
10. Thread measurement by three wire method or Tool maker’s microscope.
11. Surface roughness measurement by Surface roughness tester.
12. Measurement of screw thread by using Profile Projector.

III YEAR

II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF MACHINE ELEMENTS

Course Code: GR20A3098 **L/T/P/C: 3/0/0/3**

III Year II Semester

Course Objectives:

1. A strong background in mechanics of material-based failure criteria underpinning thesafety-critical design of machine components
2. An understanding of the origins, nature and applicability of empirical designprinciples, based on safety considerations
3. An overview of codes, standards and design guidelines for different elements
4. An appreciation of parameter optimization and design iteration
5. An appreciation of the relationships between component level design and overallmachine system design and performance.

Course Outcomes:

1. Design a Journal bearings subjected to static and dynamic loading.
2. Compute the dimensions of I.C engine parts subjected to variable loads.
3. Solve the dimensions of I.C engine rotary parts subjected to variable loads.
4. Design of spur gears subjected to static and dynamic loading.
5. Compute the dimensions of the power screws and springs considering various types ofloads.

UNIT I

Bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings–Clearance ratio–Heat dissipation of bearings, bearing materials
Journal bearing design–Ball and roller bearings–Static loading of Ball and Roller bearings, Bearing life. Design- Dynamic load, equivalent radial load, selection of Ball and Roller bearings.

UNIT II

Engine parts: Pistons, Forces acting on piston–Construction, Design and Proportions of piston, Cylinder and Cylinder liners.

UNIT III

Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends.
Crank and Crank shafts: Crank pin, Crankshaft - strength and proportions of over hung and center cranks.

UNIT IV

Gears: Spur gears -Causes of gear tooth failure-Lewis equation-Dynamic load factor-compressive strength-Design analysis of gears-Estimation of centre distance, moduleand face width, Check for dynamic and wear considerations.

UNIT V

Mechanical Springs: Stresses and deflections of helical springs–Extension-compression springs – Springs for fatigue loading – natural frequency of helicalsprings–Energy storage capacity–helical torsion springs–Co-axial springs, leaf springs **Design of power screws:** Design of screw-Stresses in power screws, Design of screwjack, design of nut, compound screw, differential screw –possible failures.

Text books:

1. Machine Design – R.S.Khrumi and J K Gupta
2. Design of Machine Elements Design, V. B. Bandari -TMH Publishers
3. Machine Design – Pandya and Shah.

References:

1. Machine Design / Schaum Series
2. Machine Design by Shigley, MH Publishers Spottes, M.F.,
3. Design of Machine elements, Prentice-Hall India, 1994.
4. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998
5. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, FifthEdition, McGraw-Hill International; 1989.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

HEAT TRANSFER

Course code: GR20A3099 **L/T/P/C: 2/1/0/3**
III B. Tech II Semester

Note: Heat transfer data book Permitted

Pre-requisite: Thermodynamics, Fluid dynamics

Course Objectives:

1. Build solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
2. Understand the governing equations and solution procedures for the conduction mode will be provided, along with solution of practical problems using empirical correlations.
3. Discuss the types of convection using dimensional analysis and empirical cases for different types of causation of flows for different geometries
4. Explore to the knowledge of heat transfer with phase change through boiling and condensation and develop the analysis and design of heat exchangers
5. Apply the physics of thermal radiation and its concepts for global context.

Course Outcomes:

1. Formulate and analyze a heat transfer problem involving conduction heat transfer both steady and unsteady state conditions
2. Apply the 1-D general heat conduction equation for different geometries with and without internal heat generation and transient cases
3. Recognize the significance of different types of convection and empirical correlation for solving real time problems with concepts including hydrodynamic and thermal boundary layers
4. Explore to the knowledge of heat transfer with phase change through boiling and condensation with relevant theories and correlations for analysis and analyze the performance parameters of heat exchangers using LMTD and NTU methods
5. the concept of radiation shape factor in real time applications and study to the relations for radiation heat transfer for black and Gray bodies

UNIT I
INTRODUCTION AND CONDUCTION HEAT TRANSFER

Modes and mechanisms of heat transfer – Basic laws of heat transfer -- General discussion about applications of heat transfer. General heat conduction equation in Cartesian, cylindrical and spherical coordinates – Simplification and forms of the field equation – Steady, unsteady and periodic heat transfer – Initial and boundary conditions.

UNIT II
ONE DIMENSIONAL STEADY AND UN STEADY STATE HEAT TRANSFER

One Dimensional Steady State Conduction Heat Transfer

One dimensional steady state conduction heat transfer through homogeneous slabs, hollow cylinders and spheres – Overall heat transfer coefficient – Electrical analogy – Critical radius of insulation. Variable Thermal conductivity–Systems with heat sources or heat generation. Extended surface (fins) heat transfer – Long fin, Fin with insulated tip and short fin, Performance of fins

One Dimensional Transient Conductive Heat Transfer

One dimensional transient conduction heat transfer in systems with negligible internal resistance. Significance of Biot and Fourier numbers. Chart solutions of transient conduction systems – Sensitivity of thermometer – Significance of time constant -- Concept of Functional Body.

UNIT III

CONVECTIVE HEAT TRANSFER

Classification of systems based on causation of flow, condition of flow, configuration of flow – Applications for developing semi empirical non- dimensional correlation for convective heat transfer – dimensional analysis – significance of non-dimensional numbers, Concepts of Continuity, Momentum and energy equation

Forced convection: External flows: Concepts about hydrodynamic and thermal boundary layer – Use of empirical correlations for convective heat transfer over flat plates, cylinders and spheres. Internal flows: Concepts about Hydrodynamic and thermal entry lengths – use of empirical relations for horizontal pipe flow and annulus flow.

Free convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and pipes.

UNIT IV

HEAT TRANSFER WITH PHASE CHANGE AND HEAT EXCHANGERS

Boiling – Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and film boiling. Condensation – film wise and drop wise condensation – Nusselt's theory of condensation on vertical plate – Film condensation on vertical and horizontal cylinders using empirical correlations.

Heat Exchangers: Classification of heat exchangers – Overall heat transfer coefficient and fouling factor – Concepts of LMTD and NTU methods – Effectiveness of heat exchangers.

UNIT V

RADIATION HEAT TRANSFER

Emission characteristics and laws of black body radiation – Total and monochromatic quantities –laws of Planck, Wein, Kirchoff, Lambert, Stefan and Boltzmann – Heat exchange between two black bodies – Concept of shape factor – Emissivity – Heat exchange between grey bodies –radiation shields – Electrical analogy for radiation networks – Irradiation, radiosity.

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer – R.C.Sachdeva / New Age International
2. Heat and Mass transfer – D.S. Kumar / S.K.Kataria & Sons

REFERENCE BOOKS:

1. Heat transfer – P.K.Nag / TMH
2. Heat and Mass transfer – Cengel / Mc Graw Hill
3. Heat and Mass transfer – R.K.Rajput / S.Chand& Company Ltd
4. Heat and Mass Transfer – Kodandaraman

Data Book: Heat and Mass Transfer – Kodandaraman

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF MANAGEMENT AND ENTREPRENEURSHIP

Course code: GR20A3140 **L/T/P/C: 3/0/0/3**
III B. Tech II Semester

Course Objectives:

1. To provide engineering and science students with an accelerated introduction to thebasics of management.
2. The course provides a framework that will enhance a person's effectiveness in thebusiness world and make familiarize management language.
3. To understand the management concepts and applications of concepts in practicalaspects of business and development of managerial skills.
4. To provide the student with a clear understanding of Entrepreneurship.
5. To give hands on experience on how to generate ideas, evaluate business model.

Course Outcome:

1. Uunderstand the significance of Management in their Profession.
2. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course.
3. Explore the Management Practices in their domain area and understand, adopt motivational theories and leadership styles and apply controlling techniques at right time for better decision making.
4. Exposed to the basic concepts of entrepreneurship and its development process.
5. Evaluate business ideas and attain hands on experience in designing value proposition and he will acquire the ability of developing a business plan / model.

UNIT I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills; Evolution of Management Thought- Classical Approach- Scientific and Administrative Management; The Behavioural approach; The Systems Approach; Contingency Approach.

UNIT II

Planning and Organizing: Planning – Planning Process, Types of Plans, Decision making and Steps in Decision Making; Principles of Organization: Span of control, organizational Design & Organizational Structures; Departmentalization, Delegation; Centralization, Decentralization.

UNIT III

Leading, Motivation and Controlling: Leadership, Power and Authority, Leadership Styles; Behavioural Leadership, Situational Leadership, Leadership Skills. Motivation – Types; Motivational Theories – Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y. - controlling – basic control process – control techniques.

UNIT IV

Nature of Entrepreneurship: Characteristics and skills of an entrepreneur, Entrepreneur scenario in India and abroad. Types of entrepreneur, types of ownership, Small business in Indian economy. Risk Reduction strategies. Strategies for growth.

Financial aspects: sources of rising capital, schemes of Department of Industries (DIC), KVIC, SIDBI, NABARD, NSIC, IFCI and IDBI.

UNIT V

Creating and Starting the venture: Creativity and the business idea (Self-discovery, Opportunity discovery); Developing the business plan (Business model – Lean canvas by Alexander Osterwalder); Marketing plan (Customer & Solution- Value proposition, Marketing & Sales); Financial plan (Validation, money), Human Resource Plan (Team).

TEXT BOOKS:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.
3. Principles and Practice of Management, L. M. Prasad, Sultan Chand & Sons, 2012
4. Entrepreneurship- Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH.2009

REFERENCES:

1. Essentials of Management, Koontz Kleihrich, Tata Mc – Graw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
3. Entrepreneurship- Rajeev Roy, Oxford, 2011
4. Intellectual Property- Deborah E.Bouchoux, Cengage, 2012

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN FOR MANUFACTURING
(PROFESSIONAL ELECTIVE- II)

Course Code: GR20A3100 **L/T/P/C: 3/0/0/3**
III Year II Semester

Course Objectives:
1. Understand modern manufacturing operations their capabilities, limitations and how to design for lowest cost.
2. Gain insight into how designers influence manufacturing schedule and cost.
3. Learn how to analyze products and be able to improve their manufacturability andlower costs.
4. Understand the relationship between customer desires, functional requirements,product materials, product design, and manufacturing process selection.
5. Understand constraints of manufacturing processes that limit design possibilities with respect to cycle time, material handling, and other factory costs.

Course Outcomes:
1. Understand the design process and selection of materials.
2. Apply various casting processes in manufacturing mechanical components
3. Apply metal joining process in the manufacturing
4. Apply automatic transfer lines to improve productivity
5. Apply various material handling systems to enhance the production.

UNIT I
Introduction: Engineering Design Process, Considerations of a good design, Description of design process, Creativity in Design, Creative thinking methods, Materials: Relation of Material selection to design and process, Process selection.

UNIT II
Design for Manufacturing: DFM guidelines and specific design rules
Machining Process: Overview of various machining processes- general design rules for machining, Dimensional tolerance and surface roughness.
Material Casting: Appraisal of various casting processes, Design guidelines for casting, Use of solidification simulation in casting design, chart. Performance characteristics, material selection process and economics of materials.
Design of Forgings: DFM guidelines for closed - die forging, parting lines of die drop forging die design.

UNIT III
Metal Joining: Appraisal of various processes, Factor in the design of weldments, General design guidelines, Pre and post treatment of welds, Effect of thermal stresses in weld joints, design for brazed joints.
Sheet metal forming: Stamping, Bending, Stretching and deep drawing, General design guide lines, Keeler, Goodman forming line diagram.

UNIT IV
Assemble Advantages: Development of assemble process, choice of assemble methods, assemble advantages, social effects of automation.

Atomic Assembly Transfer Systems: Continuous transfer, intermittent transfer, Indexing Mechanism, Operator paced free transfer machine.

UNIT V

Design of Manual Assembly: General design guidelines for manual assembly, Assembly efficiency, Classification system for manual handling, Insertion and fastening, Effect of part symmetry, part thickness, size and weight on handling time, parts required for two hands for manipulation, effect of symmetry and chamfer design on insertion operations, Estimation of insertion time.

Text Books:

1. Engineering Design - George E Dieter.
2. Assembly automation and product design, Geoffrey Boothroyd.

References:

1. Henry Peck – "Designing for manufacture", Sir Isaac Pitman and Sons Ltd.,1973.
2. Matousek – "Engineering Design", Blackie and sons, 1956.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPUTATIONAL FLUID DYNAMICS
(PROFESSIONAL ELECTIVE- II)

Course Code: GR20A3101 **L/T/P/C: 3/0/0/3**

III Year II Semester

Course Objectives:

1. Describe the physical significance of each term in the governing equation for CFD
2. Identify the use of a commercial CFD package to solve practical CFD problems
3. Formulate explicit and implicit algorithms for solving the Navier-stokes equations
4. Measure and analyze the numerical error in CFD discretization schemes
5. Develop finite difference and finite volume forms of the CFD equation for heattransfer and fluid flow.

Course Outcomes:

1. Classify the partial differential equations to understand the behavior of the equations
2. Analyze the semi implicit and explicit algorithms for staggered grid and non-staggered grids
3. Calculate the flow field with SIMPLE and SIMPLER schemes
4. Compare the various discretization schemes for convection diffusion equation
5. Assess the pressure velocity coupling, coupled velocity and temperature field.

UNIT I

Elementary details in numerical Techniques: Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences. Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, and Direct Methods for banded matrices.

UNIT II

Finite Difference Applications: Heat conduction and Convection – steady state heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure. Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modelling: Introduction, elementary finite difference quotients, implementation aspects of finite difference equations, consistency, explicit and implicit methods.

UNIT III

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme. Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass,Newton's second law of motion, expanded forms of Navier-stokes equations, conservation ofenergy principle, special forms of the Navier-stokes equations.

UNIT IV

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.

UNIT V

Finite Volume Method for correction problems: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation

and QUICK scheme, pressure velocity coupling, staggered, SIMPLE AND SIMPLER schemes. FVM for diffusion problems, FVM for 1-D steady state diffusion problems, FVM for 2D diffusion problems.

Text books:

1. Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.
2. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers
3. Computational fluid dynamics/ T. J.C'hung/ Cambridge University press, 2002.
4. Introduction to Computational fluid dynamics, Finite Voume Method H.Versteeg,Malala Sekra
5. Computational fluid dynamics for Engineers Vol.1,2 and 3 Klaus A. Hoffmann and Steve T. Chiang
6. Computational Methods for Fluid Dynamics 3rd Edition Joel H. Ferziger AND Milovan Peric

References:

1. Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications
2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
UN-CONVENTIONAL ENERGY SOURCES
(PROFESSIONAL ELECTIVE- II)

Course Code: GR20A3102 **L/T/P/C: 3/0/0/3**
III Year II Semester

Course Objectives:
1. Introduce the need of the non-convectional energy sources.
2. Differentiate various solar collectors
3. Identify the energy resources utilization systems.
4. Recognize the source and potential of wind energy and understand the classificationsof wind mills.
5. Summarize the principles of bio-conversion, ocean energy and geo thermal energy.

Course Outcomes:
1. Choose the appropriate renewable energy as an alternate for conventional power inany application.
2. Understand principles of various solar collectors and use them in different applications
3. Inculcate the knowledge on usage of alternate energy sources in I.C Engines
4. Analyze large scale demand of heat energy for meeting day to day domestic, institutional and industrial requirements can be met by utilizing solar thermal systems, biogas, PV cells, wind energy, Geothermal, MHD etc.
5. Know various energy conversion techniques

UNIT I
Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT II
Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/ cooling techniques, solar distillation and drying, Photovoltaic energy conversion.cooking, I.C. Engine operation, and economic aspects.

UNIT IV
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India. OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

UNIT V
Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

Text books:

1. Renewable Energy Sources / Twidell and Weir / Taylor and Francis / 2nd SpecialIndian Edition.
2. Non- conventional Energy Sources / G.D. Rai / Dhanpat Rai and Sons.

References:

1. Energy Resources Utilization and Technologies / Anjaneyulu and Francis / BS Publications/2012.
2. Principles of Solar Energy / Frank Krieth and John F Kreider / HemispherePublications.
3. Non-Conventional Energy / Ashok V Desai / Wiley Eastern.
4. Non-Conventional Energy Systems / K Mittal / Wheeler.
5. Renewable Energy Technologies / Ramesh and Kumar / Narosa.
6. Renewable Energy Resources / Tiwari and Ghosal / Narosa.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MICROPROCESSORS IN AUTOMATION
(PROFESSIONAL ELECTIVE- II)

Course Code: GR20A3103 **L/T/P/C: 3/0/0/3**

III Year II Semester

Course Objectives:

1. Memorize the basic concepts of digital electronics and microprocessors.
2. Explain the microprocessor instruction cycles and interfacing.
3. Develop knowledge on microprocessor programming and its application to real time.
4. Experiment on interfacing microprocessor with various input and output devices.
5. State the concepts on digital control and digital algorithm.

Course Outcomes:

1. Gain knowledge on digital electronics concepts.
2. Understand the instruction cycles and timings of microprocessor.
3. Demonstrate program with microprocessor's according to the required application.
4. Relate interface, Microprocessor's with various input and output devices.
5. Analyze the concepts of interrupts and handle the microprocessor systems without interrupts.

UNIT I

Number Systems, codes, digital electronics: Logic Gates, combinational circuits design, Flip-flops, Sequential logic circuits design: Counters, Shift registers. Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals.

UNIT II

Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

UNIT III

Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller; Interfacing peripherals: Programmable peripheral interface (8255).

UNIT IV

Interfacing Analog to Digital Converter AND Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features

UNIT V

Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z-Transform, Digital Filters, Implementation of Digital Algorithm.

Text Books:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann,PHI Learning Private Limited
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino,Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, IndianEdition, 2007).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, PrenticeHall

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPOSITE MATERIALS
(OPEN ELECTIVE- II)

Course Code: GR20A3104 **L/T/P/C: 3/0/0/3**

III Year II Semester

Course Objectives:

1. understand the mechanical behavior of composite materials
2. Impart various methods of manufacturing of composite materials
3. Identify importance of polymeric matrix composites with respect to metals
4. Introduce the concepts of modern composite materials
5. Provide knowledge on various analysis of composite materials

Course Outcomes:

1. Identify and explain the types of composite materials and their characteristic features
2. Understand and explain the methods employed in composite fabrication.
3. Understand the differences in the strengthening mechanism of composite and its corresponding effect on performance and application;
4. Understand the various criterions for isotropic, anisotropic and composite materials, prediction of laminates failure.
5. Appreciate the theoretical basis of the experimental techniques utilized for failure mode of composites.

UNIT I

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

UNIT II

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT III

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria.

UNIT IV

Von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai- Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates.

UNIT V

Analysis of laminated plates- equilibrium equations of motion, energy formulation,static bending analysis, buckling analysis, free vibrations, natural frequencies.

Text Books:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGrawHill,1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGrawHill,1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY
COMPUTER AIDED MODELING AND 3D PRINTING LAB

Course Code: GR20A3105 **L/T/P/C: 0/0/3/1.5**
III Year II Semester

Course Objectives:
1. Model 3D parts using CAD software.
2. Application of CAD software in creating assembly of machine components.
3. Importance of parametric curves to model complex machine parts.
4. Different layouts of drawings, orthographic projections.
5. Introduction to various file formats and printing parts using 3D Printer.

Course Outcomes:
1. Create complex geometry machine components.
2. Create engineering assemblies using appropriate assembly constraints.
3. Model complex parts using Advance feature options and printing them using 3DPrinter.
4. Convert CAD models into various file formats which are compatible to other software.
5. Create detailed drawing for parts and assemblies of engineering components.

Syllabus:
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: Practice Exercise related to Sketch and Basic Feature Options.

Task 2: Practice Exercise related to Advanced Feature Options.

Task 3: Creating Parts related to Plummer Block Assembly.

Task 4: Creating Parts related to Pipe vice.

Task 5: Creating Parts related to Footstep Bearing.

Task 6: Assembly of Plummer Block.

Task 7: Assembly of Pipe vice

Task 8: Assembly of Footstep Bearing.

Task 9: Part and Assembly Drawings of Plummer Block Assembly

Task 10: Part and Assembly Drawings of Pipe vice

Task 11: Part and Assembly Drawings of Footstep Bearing.

Task 12: 3D Printing of Model 1

Task 13: 3D Printing of Model 2

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HEAT TRANSFER LAB

Course Code: GR20A3106 **L/T/P/C: 0/0/3/1.5**
III Year II Semester

Note: Heat transfer data book Permitted

Course Objectives:

1. Understand the basic laws of heat transfer and its applications.
2. Recognize the practical significance of various parameters those are involved in different modes of heat transfer
3. Apply the knowledge of heat transfer in an effective manner of different application.
4. Analyze the process of Condensation.
5. Gain experience in designing experiments for thermal systems.

Course Outcomes:

1. Evaluate heat transfer through conduction mode of heat transfer such as thermal conductivity of metal rod, composite material
2. Analyze the heat transfer phenomena in case of insulating material by conducting experiments on lagged pipes and concentric spheres
3. Measure the convective heat transfer coefficient in case of forced and Natural Convection and assess the performance parameters of the pin fin
4. Apply the knowledge of physics of radiation on black and gray bodies, evaluation of Stefan Boltzmann constant.
5. Explore to the phase change heat transfer analysis for evaluation of critical heat flux and calculate the overall heat transfer coefficient in parallel and counter flow heat exchangers.

LIST OF EXPERIMENTS:

1. Composite wall Apparatus.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Heat transfer in forced convection apparatus.
7. Heat transfer in natural convection
8. Parallel and counter flow heat exchanger.
9. Emissivity apparatus.
10. Stefan Boltzmann Apparatus.
11. Heat transfer in drop and film wise condensation.
12. Heat Pipe Apparatus.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MINI PROJECT WITH SEMINAR

Course Code: GR20A3141 **L/T/P/C: 0/0/4/2**
III Year II Semester

Course Objectives:

1. Demonstrate a wide range of skills learned to deliver a project.
2. Encourage multidisciplinary research through the integration learned.
3. Develop problem solving, analysis, synthesis and evaluation skills.
4. Encourage teamwork.
5. Improve communication and presentation skills during project work.

Course Outcomes:

1. **1.** Formulate hypothesis for the problem statement with sound technical knowledge from selected project domain.
2. 2. Design Engineering Solution to the problem statement with systematic approach.
3. 3. Analyse and develop an efficient solution for implementation of the project.
4. 4. Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach.
5. 5. Demonstrate professionalism with ethics while preparing and presenting the project work.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
VALUE ETHICS AND GENDER CULTURE

Course code: GR20A2002 **L/T/P/C: 2/0/0/2**
III B. Tech II Semester

Course Objectives:

1. To understand about the importance of ethical values and self-development.
2. To understand the significance of human conduct and personality development.
3. To enable students to imbibe and internalize the value and Ethical behavior inprofessional lives.
4. To provide a critical perspective on the socialization of men and women.
5. To create an awareness on gender violence and condemn it.

Course Outcomes

1. To enable the student to understand the core values that shapes the ethical behaviorwith self-development.
2. Student will be able to realize the significance of ethical human conduct andpersonality development.
3. Students will be able to the ethical behavior in their professional lives.
4. Students will attain a finger grasp of how gender discrimination works in our societyand how to counter it.
5. Students will develop a better understanding on issues related to gender and know howto respond gender violence to condemn it.

UNIT I

Values and Self-Development–social values and individual attitudes, Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

- A Case study on values and self-development

UNIT II

Personality and Behaviour Development-positive thinking, punctuality, avoiding fault finding, Free from anger, Dignity of labour, religious tolerance, Aware of self-destructive habits.

- A Case study on Personality

UNIT III

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

- A Case study on professional ethics

UNIT IV

Introduction to Gender - Definition of Gender, Basic Gender Concepts and Terminology, Attitudes towards Gender, Social Construction of Gender.

- A Case study/ video discussion on attitudes towards gender

UNIT V

Gender-based Violence -The concept of violence, Types of Gender-based violence, the relationship between gender, development and violence, Gender-based violence from a human rights perspective.

- A Case study/ video discussion on gender-based violence in view of human rights

Textbooks

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whit beck, 2e, Cambridge University Press 2015.
3. A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, GoguShyamala, Deepa Sreenivas and Susie Tharu and published by Telugu Akademi, Hyderabad,Telangana State in the year 2015.

Reference Books

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "I Fought For My Life…and Won."Available onlineat: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
3. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard,Michael J Rabins, 4e , Cengage learning, 2015.
4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

IV YEAR

I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CAD/CAM

Course Code: GR20A4025 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Objectives:

1. Gain knowledge in CAD/CAM hardware and softwares.
2. Understand how to create wire-frame, surface and solid models of the components.
3. Understand various surface entities.
4. Apply CNC and APT programming knowledge in Manufacturing of machine members
5. Analyze the quality of product using advanced inspection and testing instruments.

Course Outcomes:

1. Understand the fundamentals of CAD/CAM, 2D and 3D transformation methods
2. Apply analytical and synthetic curves to develop wire-frame models of the objects.
3. Apply synthetic surfaces and solids entities to create surface and solid models of theobjects.
4. Apply CNC and APT programming and Group Technology in industry to improve the production rate and quality.
5. Apply process plans, computer controlled instruments and various manufacturingsystems to increase the production rate and quality of the product.

UNIT I

Introduction to CAD/CAM: Definition, Fundamentals of CAD, Product cycle, Types of Productions, Design Process, Applications of Computer to design process, CAD/CAM Hardware, Basic structure, CPU, Memory types, input devices, output devices. CAD software, Functions of Graphic software, Transformation-scaling, rotation and translation, segmentation, windowing, clipping, hidden surface removal.

UNIT II

Geometric Modeling: Types of Geometric models, Representation of curves-parametric and non-parametric, orders of continuity of curves.

Wireframe modelling-analytical entities, synthetics entities-Hermitte cubic curve, Bezier curve, B-Spline and NURBS.

UNIT III

Surface Modelling-Analytical surface entities-plane, ruled surfaces, tabulated cylinder, surface of revolution, Synthetics surfaces-Hermitte bi-cubic, Bezier, B-spline and NURBS surfaces, Special surfaces-Coons patch, Blending surface.

Solid Modelling-analytical and synthetic solid entities. Boundary, CSG and Sweep representations.

UNIT IV

Numerical control: NC, CNC, NC basic elements and structure, NC coordinate, motion control systems, applications, benefits. CNC Manual Part Programming, Computer Aided Part Programming-APT programming.

Group Technology (GT): Part family, part classification and coding systems, GT cells, advantages and applications.

UNIT V

Computer Aided Processes Planning (CAPP), Retrieval type and Generative type, benefits. **Computer Aided Quality Control (CAQC):** Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-non-optical, and computer aided testing, integration ofCAQC with CAD/CAM. **Computer integrated manufacturing systems:** Types of Manufacturing systems-FMS, Material handling systems, CIMS benefits.

Text books :

1. CAD / CAM byMikell P. Groover and E.W. Zimmers. JR /PHI-Eastern Economy Edition
2. CAD / CAM Theory and Practice by Ibrahim Zeid / TMH

References :

1. Automation, Production systems and Computer integrated Manufacturing/ Groover/P.E
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / FaridAmirouche / Pearson
4. CAD/CAM: Concepts and Applications/Alavala/ PHI
5. Computer Numerical Control Concepts and programming / Warren S Seames /Thomson.

Teaching Methodology:

- Power point Presentations
- Working models
- White board and marker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INSTRUMENTATION AND CONTROL SYSTEMS

Course Code: GR20A4026 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Objectives:
1. Understand the basic concepts measuring instruments and sources of error,classification and elimination of error.
2. Illustrate on measurements of displacement, temperature, pressure, Level, Flow, Speedand Vibration.
3. Knowledge to apply the concepts of physics and electric/electronics to measurementand control systems.
4. Understand the concept of measurement of acceleration, vibration, force, torque andpower.
5. Get sufficient knowledge on stress strain measurements, measurement of humidity and element of control systems.

Course Outcomes:
1. Become conversant with various measuring systems and the errors of measurement.
2. Understand and explain the concepts of measurement of displacement and temperature
3. Explain the various theories of pressure, level of flow measurement.
4. Explain and appreciate the use of sensor and transducer.
5. Explain the concept of different elements of control systems of various industrial applications.

UNIT I
Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples.Static performance characteristics, Dynamic performance characteristics –sources of error, Classification and elimination of error.

UNIT II
Measurement of Displacement: Theory and construction of various transducers to measure displacement Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.
Measurement of Temperature: Classification – Ranges – Various Principles of measurement– Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

UNIT III
Measurement of Pressure: Units–classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleodpressure gauge.
Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic,magnetic, cryogenic fuel level indicators – Bubler level indicators.
Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

UNIT IV

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer

Measurement of Acceleration and Vibration: Different simple instruments – Principlesof Seismic instruments – Vibrometer and accelerometer using this principle.

Measurement of humidity – Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT V

Stress Strain measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsionmeters, Dynamometers.

Elements of control systems: Introduction, Importance – Classification – Open loop and closed loop control systems Servomechanisms–Examples with block diagrams– Temperature, speed and position control systems.

Text books:

1. Measurement Systems: Applications and design by D.S Kumar.
2. Mechanical Measurements / BeckWith, Marangoni, Linehard, PHI / PE

References:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation byManik and Dhanesh/ TMH
2. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
3. Experimental Methods for Engineers / Holman.
4. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
5. Instrumentation and mech. Measurements by A.K. Tayal ,Galgotia Publications
6. Instrumentation, measurement and analysis by B.C.Nakra and K.K.Choudhary, TMH
7. Mechanical Measurements /sahani

Teaching Methodology:

- Power point Presentations
- Working models
- White board and marker

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLEXIBLE MANUFACTURING SYSTEMS

(PROFESSIONAL ELECTIVE- III)

Course Code: GR20A4027 **L/T/P/C: 3/0/0/3**

IV Year I Semester

Course Objectives:

1. Inculcate the knowledge on basics of Flexible Manufacturing System
2. Impart knowledge about the design, operation, and selection of Flexible Manufacturing System unit
3. Impart knowledge on Group Technology and its importance.
4. Familiarized processing stations and material handling systems used in FMS
5. Provide knowledge on cutting tools and tool management.

Course Outcomes:

1. Know broad based understanding of the interdisciplinary subject 'tribology' and its technological significance
2. Apply the principles of lubrication, lubrication regimes, theories of hydrodynamic,elasto hydro dynamic and mixed/ boundary lubrication
3. Apply the basic theories of friction to predictions about the frictional behavior of commonly encountered sliding interfaces.
4. Analyze about consequences of wear, wear mechanisms, wear theories and analysis ofwear problems.
5. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding.

UNIT I

Introduction: Basic components of FMS – Types of FMS layouts- Advantages and Disadvantages of FMS Implementation – Various Equipment's and their Functions Required for an FMS – CIM Technology & CIM Technology – FMS Concepts.

UNIT II

Manufacturing Cell: Introduction and definition of cell – Classification of Cells – Standalone NC Machine Tools – Single NC Machine Cellor Mini Cell – Integrated Multi Machine Cell – Unattended Machining – Differences between FMC and FMS.

Just in time (JIT) System: Introduction and definition of JIT – goals of JIT and concept – objectives and ingredients of JIT – Quality and Quantity Principles of JIT – Benefits and implementations of JIT.

UNIT III

Group Technology & Machining Centres:

Introduction and definition of Group Technology – Reasons for Adopting Group Technology – Benefits of Group Technology Affecting Many Areas of a Company – Obstacles to Application of GT.

Introduction and types of machining centres – horizontal Machining Centres merits and demerits– vertical machine centre merits and demerits – Automated Features and Capabilities of Machining Centre.

UNIT IV

Coordinate Measuring Machines &Automated Material Movement and Storage System

Introduction – CMM construction – probe – machine structure - types of CMM – functions of CMM Computers – Operational Cycle Description – CMM Applications and advantages.

Introduction – types of AVGS – Unit Load Carries: - Side Loading and High Lifting Types – Automated Guided Transport Carts- Analysis of AGV Systems – Automated Storage and Retrieval Systems (AS/RS) – Unit Load AS/RS -Mini Load AS/RS – Carousel AS/RS – Analysis of AS/RS – Industrial Robots – Basic Components types of a Robotic System – Applications of Industrial Robots.

UNIT V

Cutting Tools and Tool Management:

Introduction - Tool Management - Tool Room Service - Tool Delivery, allocation and data transfer- Fault Sensing - Tool Strategies - Tool Preset, Identification and Data Transfer - Bar Code Scanning - Radio Frequency Identification - The Microchip - Data Transfer - Tool Monitoring and Fault Detection - Experimental Setup and Data Collection.

Text books:

1. Flexible manufacturing system by H. K. Shivanand, M. M. Benal and V. Koti.

References:

1. Hand books of flexible manufacturing systems by Nand K. Jha
2. Flexible manufacturing system: Recent Developments by A. Raouf and M.Ben – Daya

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
TRIBOLOGY
(PROFESSIONAL ELECTIVE- III)

Course Code: GR20A4028 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Objectives:

1. Provide broad based understanding of the interdisciplinary subject 'tribology' and its technological significance.
2. Understand the nature of engineering surfaces, their topography and learn aboutsurface characterization techniques.
3. Understand the genesis of friction, the theories/laws of sliding and rolling friction.
4. Learn about the contact of solid surfaces and their interactions.
5. Learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems.

Course Outcomes:

1. Know broad based understanding of the interdisciplinary subject 'tribology' and its technological significance
2. Apply the principles of lubrication, lubrication regimes, theories of hydrodynamic, elasto hydro dynamic and mixed/ boundary lubrication
3. Apply the basic theories of friction to predictions about the frictional behavior of commonly encountered sliding interfaces.
4. Analyze about consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
5. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding.

UNIT I

Introduction to Tribology: Properties of oils and equation of flow, Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants.

UNIT II

Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D.

UNIT III

Idealized Journal Bearing: Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, end leakages in journal bearing, numerical problems. Slider / Pad Bearing with a Fixed and Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, numerical examples.

UNIT IV

Oil Flow and Thermal Equilibrium of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings. Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.

UNIT V

Bearing Materials: Commonly used bearings materials, properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Behavior of tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering.

Text books:

1. Fundamentals of Tribology, Basu S K., Sengupta A N., Ahuja B.B., , PHI 2006
2. Introduction to Tribology Bearings, Mujumdar B. C., S. Chand company pvt. Ltd2008.

References:

1. Theory and Practice of Lubrication for Engineers, Fuller, D., New York company1998
2. Principles and Applications of Tribology, Moore, Pergamaon press 1998
3. Tribology in Industries, Srivastava S., S Chand and Company limited, Delhi 2002
4. Lubrication of bearings – Theoretical Principles and Design, Redzimovskay E I.,Oxford press company 2000

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FINITE ELEMENT ANALYSIS
(PROFESSIONAL ELECTIVE- III)

Course Code: GR20A4029 **L/T/P/C: 3/0/0/3**

IV Year I Semester

Course Objectives:

1. Recognize the fundamental concepts of the theory of the finite element method
2. Develop proficiency in the application of the finite element method (modeling,analysis, and interpretation of results) to realistic engineering problems.
3. Demonstrate the governing FE equations for systems governed by partial differential equations
4. Illustrate the principle of mathematical modeling of engineering problems
5. Introduce applications of finite element method

Course Outcomes:

1. Discuss the fundamental understanding of the theory of the finite element method
2. Develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems to develop the ability to generate the governing FE equations for systems governed by partial differential equations
3. Describe the principle of mathematical modeling of engineering problems
4. Interpret the complete idea on applications of finite element method
5. Explain the limitations of the FE method and understand the possible error sources in its use.

UNIT I

Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, potential energy method, Variational formulation of boundary value problems, Basic concept of Finite Element Method.

UNIT II

One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics, longitudinal vibration and mode shapes, transverse deflections and natural frequencies.

UNIT III

Two dimensional equation, variational formulation, finite element formulation, triangular elements- shape functions, elemental matrices and RHS vectors; beam equations, transverse deflection, longitudinal vibration and mode shapes, natural frequencies…

UNIT IV

Application to thermal problems, assembly of elemental matrices, solutions of problem from heat transfer, torsion of non-circular shafts, quadrilateral and higher order elements. Plane stresses and plane strain problems, body forces and thermal loads, plate and shell elements.

UNIT V

Natural coordinate systems, iso-parametric elements and shape functions, numerical integration and application to plane stress problems, matrix solution techniques, solution of dynamic problems, Introduction to FE software.

Text Books:

1. Reddy J.N., An Introduction to Finite Element Method, 3rd ed., Tata McGraw Hill, 2005.
2. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi, 2007.
3. Rao S.S., The Finite Element Method in Engineering, 3rd ed., Butterworth Heinemann,2004
4. Chandraputla and Belegundu, Introduction to Finite Elements in Engineering, 3rd ed., Prentice Hall, 1990

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTERNET OF THINGS
(PROFESSIONAL ELECTIVE – III)

Course Code: GR20A3063 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Objectives:

1. Understand the basic characteristics of IoT system
2. Realize the different IoT Protocols and architectures
3. Analyze the cloud interface and security concerns of IoT devices
4. Introduce programming in various real-time hardware platforms
5. Design a complete IoT ecosystem for various smart applications

Course Outcomes:

1. Ability to learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components , infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components ,challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

UNIT I

Introduction to IoT: Characteristics of IOT, Applications of IOT, IOT Categories, IOT Enablers and Connectivity Layers, Sensors, Actuators, IOT Components & Implementation, Challenges for IOT

UNIT II

IOT Networking & Connectivity Technologies: Connectivity terminologies-IOT Node, LAN,WAN, Gateway, IOT protocol Stack vs. Web Stack, IOT Identification and Data Protocols-IPV4,IPV6,HTTP,MQTT,COAP,AMQP,DDS Connectivity Technologies – Zigbee, Bluetooth, LoRa

UNIT III

Cloud for IOT: IOT with Cloud-Challenges, Cloud service providers for IOT-Overview, Cloudservice model, Cloud Computing – Security aspects, Case Study, Fog computing, Edge computing

UNIT IV

Hardware Platforms: Programming with Arduino-Features of Arduino, Components of Arduino Board, Arduino IDE, Program Elements, Raspberry Pi – Introduction, Architecture, PIN Configuration, Implementation of IOT with Raspberry Pi

UNIT V

IOT Applications : Smart Homes-Smart Home Origin, Technologies, Implementation, Smart Grids-Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IOT-Requirements, Design Considerations, Applications

Text books:

1. Internet of Things, Jeeva Jose, Khanna Publishing, 2018
2. Internet of Things, Abhishek S Nagarajan, RMD Sundaram, Shriram K Vasudevan, Wiley, 2019

Reference books / Weblinks:

1. The Internet of Things, Michael Miller, Pearson Education Limited, 2015
2. IoT Applications, Security Threats, and Countermeasures, Padmalaya Nayak, Niranjan Ray, P. Ravichandran,Taylor &Francis,2021
3. Internet of Things: Architecture, Implementation and Security, MayurRamgir, Pearson Education Limited, 2019
4. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry,Pearson Education Limted, 2017
5. Beginning LoRa Radio Networks with Arduino, Pradeeka Seneviratne, Apress, 2019

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUTOMATION IN MANUFACTURING
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR20A4030 **L/T/P/C:3/0/0/3**

IV Year I Semester

Course Objectives:

1. Impart knowledge on automation of Plant Layout, Production concepts andmathematical models.
2. Learn about analysis of automated flow lines, assembly systems and line balance.
3. Learn about automation of material handling systems.
4. Impart knowledge on automated assembly systems and line balancing methods.
5. Impart knowledge on automated material handling systems.

Course Outcomes:

1. Explain the major automation theories, approaches and methodologies used inmanufacturing;
2. Build up the skills in the actual implementation of automation methods
3. Apply the knowledge for implementing the automated flow lines
4. Employ and implement the automation systems in machining process.
5. Design the automated flow line for new products.

UNIT I

Introduction: Introduction to automation, principles, reasons, types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

UNIT II

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT III

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT IV

Automated material handling and storage systems: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT V

Adaptive control systems: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

Text Books:

1. Mikell P.Groover, Automation, Production Systems, and Computer-integrated Manufacturing, prentice Hall
2. SeropeKalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology,
3. 7th edition, Pearson
4. YoramKoren, Computer control of manufacturing system, 1st edition
5. Ibrahim Zeid, CAD/CAM: Theory AND Practice, 2nd edition.

References:

1. Automotive Engineering / Newton Steeds and Garrett
2. Automotive Mechanics / G.B.S. Narang
3. Automotive Mechanics / Heitner
4. Automotive Engines / Srinivasan

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ARTIFICIAL INTELLIGENCE
(PROFESSIONAL ELECTIVE – IV)

Course Code: GR20A3046 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Prerequisites:

A course in Artificial Intelligence would require the knowledge of following concepts:

- Logic Theory
- Probability Theory
- Numerical Analysis
- Operations on Matrices

Course Objectives:

1. Understand both the achievements of AI and the theory underlying those achievements. Infer different searching strategies that are suitable for the problem tobe solved
2. Recognize the ways to represent knowledge and infer resolution using prepositional and first order logic.
3. Understand the representation of uncertain knowledge and conditional distributions using Bayesian networks.
4. Comprehend the principles of temporal models, hidden markov models, decision trees.
5. Enable the student to apply artificial intelligence techniques in applications which involve perception, reasoning and learning.

Course Outcomes:

1. Select an appropriate searching strategy for developing intelligent agents to findsolution in optimized way using building blocks ofAI.
2. Apply prepositional and first order logic methods to resolve decisions for knowledgebased agents.
3. Practice uncertain knowledge and reasoning handling using Bayesian networks
4. Analyze the working of temporal models, hidden markov models, decision trees.
5. Write AI programs and construct small robots capable of performing perception and movement based on techniques learnt in the course.

UNIT I

Introduction to AI: Introduction, Foundation of AI, History of Intelligent Agents, Agents and environments, Concept of Rationality, Nature of environments & Structure of Agents, Problem solving agents and formulation, Searching For Solutions and Strategies, Uninformed search strategies BFS, DFS, Heuristic approach, Greedy best search, A* Search, Game Playing: Adversal search, Games, Min-Max algorithm, Optimal decisions in multiplayer games, Alpha Beta pruning.

UNIT II

Knowledge Representation & Reasons: Logical agents, Knowledge based agents, The Wumpus world, Logic: Proportional logic, Resolution patterns in proportional logics, Resolution: Forward and Backward chaining, First order logic: Inference in First order logic, Proportional vs first order inference, Unification & Lifting, forward chaining, Resolution, Practice problems.

UNIT III

Uncertain Knowledge and Reasoning: Uncertainty-Acting under uncertainty ,Basic probability notion, the axioms of probability, inference using full joint distribution, Independence, Bayes' rule.

Probabilistic Reasoning: Representing Knowledge in uncertain domain, the semantics of Bayesian networks, efficient representations of conditional distributions, exact inference in Bayesian networks, approximate inference in Bayesian networks.

UNIT IV

Probabilistic reasoning over time: Time and uncertainty, inference in temporal model, Hidden Markov models.

Learning: Learning from observations: Forms of learning, inductive learning, learning decision trees, ensemble learning, why learning works.

UNIT V

Perception: Introduction, Early Image Processing operations- Edge detection, image segmentation. Object recognition, Using vision for manipulation and navigation.

Robotics: Introduction, Robot hardware, robotic perception, planning to move, Robotic software architectures, application domains.

Text books:

1. Artificial Intelligence-A modern approach-by Staurt Russel, Peter Norvig, 2nd edition, PHI/Pearson

References:

1. Artificial Intelligence – Riche & K.Night , 2ndeditionTMH.
2. Paradigms of Artificial intelligence programming, case studies in common lisp-Peter.Norvig, Morgan Kaufmann.ISBN-13:978-1558601918.
3. Robotics: Fundamental Concepts and Analysis –Ashitava Goshal, oxford.
4. A Textbook of Robotics 1-Basic Concepts-M. Shoham-Springer US.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
REFRIGERATION AND AIR-CONDITIONING
(PROFESSIONAL ELECTIVE- IV)

Course Code: GR20A4031 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Objectives:

1. Familiarize with the terminology associated with refrigeration systems andair conditioning
2. Understand basic VCRS and the effects of sub cooling and super heating.
3. Explore to Vapour absorption system, steam jet refrigeration and working principle
4. Understand the basics of psychrometry practice of applied psychrometry and acquire the skills required to model, analyze and design different refrigeration as well as air conditioning processes and components.
5. Discuss the various types and its adoptability in the various environment and application areas of different components.

Course Outcomes:

1. Explain the conventional and alternate refrigerants and air refrigeration methods
2. Understand various refrigeration systems and its components.
3. Apply the theoretical and mathematical principles to simple, complex Vapour compression and Vapour absorption refrigeration system.
4. Discuss about Psychrometry properties, different process of Air-Conditioning systemsin various applications.
5. Evaluate the practice of thermal and environmental conditions, seasonal efficientsystem

UNIT I
Introduction
Introduction to Refrigeration, Necessity, Methods of refrigeration, Unit of refrigeration; Coefficient of performance (COP), Refrigerants- Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendlyRefrigerants.
Air Refrigeration Systems: Reversed Carnot refrigeration cycle. Temperature Limitations, Bell Coleman air refrigeration cycle, Necessity of cooling the Aeroplane, Aircraft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems.

UNIT II
Vapour Compression (VC) Refrigeration Systems:(A) Simple Vapour Compression (VC) **Refrigeration systems**- Limitations of Reversed Carnot cycle with Vapour as the refrigerant;Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on P-V,T-S and P-H diagrams; Effects of operating conditions on COP.

UNIT III
Vapour Absorption Refrigeration Systems: Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Relative merits and demerits, Properties of aqua ammonia; Electrolux Refrigeration.Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits. Cascade Refrigerating Systems- Necessity, Selection of Pairs of refrigerants for the system,Concept of cascade temperature, Analysis, Multi-staging.

UNIT IV

Psychrometry and Air Conditioning Processes: Properties of Air-water vapour mixture-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Wet bulb temp, Psychometric chart, Psychrometry of air-conditioning processes, Basic processes in conditioning of air; Psychometric processes in air washer- Problems

Air- Conditioning Load Calculations: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart- Problems

UNIT V

Air Conditioning Systems with Controls and Accessories: Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Problems.

Refrigeration and Air Conditioning Equipment: Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils- Problems.

TEXT BOOKS:

1. A course in Refrigeration and Air Conditioning – Arora and Domkundwar, DhanpatRai andsons.
2. Refrigeration and Air conditioning –C.P. Arora, TMH, New Delhi.

REFERENCES:

1. Refrigeration and Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall ofIndia.
2. Refrigeration and Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
3. Refrigeration and Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.
4. Refrigeration and Air conditioning by R.S.Khurmi.

Data book: Refrigeration and Psychrometric Properties (charts and tables) by C P Kothandaraman

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MECHATRONIC SYSTEMS
(PROFESSIONAL ELECTIVE- IV)

Course Code: GR20A4032 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Objectives:

1. Introduce fundamentals of interdisciplinary components and their integration inMechatronic system design approach.
2. Impart the knowledge of Micro Processors, Micro Controllers, Programmable Logic Controllers and its role in mechatronic system.
3. Understand the use of Micro Sensors and their applications in various fields.
4. Understand the Principle of automatic control and real time motion control systems,with the help of electrical drives and actuators.
5. Develop an ability to design a system, component, or process of mechatronic systems.

Course Outcomes:

1. Be proficient in Programming Micro controllers.
2. Select appropriate sensors, transducers and actuators to monitor and control thebehaviour of a process or product.
3. Apply design principles of electrical, mechanical, hydraulic and pneumatic systems todevelop actuators and motion controllers.
4. Develop PLC system and programs for a given task.
5. Integrate mechanical electronics, control engineering in design of mechatronicssystems.

UNIT I
Introduction: Definition of Mechanical Systems, Philosophy and approach; Systems andDesign: Mechatronic approach, Integrated Product Design, Modeling, Analysis and Simulation, Man-Machine Interface.

UNIT II
Sensors and transducers: Classification, Development in Transducer technology, Opto-electronics-Shaft encoders, CD Sensors, Vision System, etc.

UNIT III
Drives and Actuators: Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems.

UNIT IV
Smart materials: Shape Memory Alloy, Piezoelectric and Magneto strictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc.;

UNIT V

Micro-mechatronic systems: Microsensors, Microactuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.

Text Books:

1. Mechatronics System Design, Devdas Shetty and Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.)
2. Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education
3. A Textbook of Mechatronics, R.K.Rajput, S. Chand and Company Private Limited
4. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATIONS RESEARCH
(OPEN ELECTIVE-III)

Course Code: GR20A4033 **L/T/P/C: 3/0/0/3**

IV Year I Semester

Course Objectives:

1. Analyze quantitative methods and techniques for effective Decisions–making.
2. Constructing models that are used in solving business decision problems.
3. Introduce the students to the use of basic methodology for the solution of linear programs and integer programs.
4. Introduce the students to the methods to solve large-scale transportation andassignment problems.
5. Illustrate how sequencing is carried out in assigning jobs to machines

Course Outcomes:

1. Apply the various linear programming techniques for optimal allocation of limited resources such as machine, material and money
2. Solve transportation problems to minimize cost and understand the principles ofassignment of jobs and recruitment polices.
3. Solve sequencing problems.
4. Apply game theory to analyze various business competitions and analyze the variouswaiting line oriented situations.
5. Develop optimum replacement policy and Dynamic Programming Techniques.

UNIT I

Introduction: Development – Definition– Characteristics and Phases of operations Research– Types of models – operation Research models– applications.

Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT II

Transportation models: Formulation – Methods for finding feasible solution, optimal solution, unbalanced transportation problem –Degeneracy.

Assignment models - Formulation – Optimal solution - Variants of Assignment Problem

UNIT III

Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production.Instantaneous demand and continuous demand and no set up cost.

UNIT IV

Theory of games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 and 2 X n games -graphical method.

Waiting lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT V

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Text books:

1. Operations Research/ Prem Kumar Gupta, Dr.D.S. Hira
2. Operations Research / S. D.Sharma-Kedarnath
3. Operation Research /J.K.Sharma/MacMilan.

References:

1. Operations Research / R.Pannerselvam,PHI Publications.
2. Introduction to O.R /Taha/PHI
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hiller and Libermann (TMH).
5. Operations Research /A.M.Natarajan, P.Balasubramani,A. Tamilarasi/Pearson Education.
6. Operations Research: Methods and Problems / Maurice Saseini, ArhurYaspan and Lawrence Friedman
7. O.R/Wayne L.Winston/Thomson Brooks/cole

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INSTRUMENTATION AND CONTROL SYSTEMS LAB

Course Code: GR20A4034 **L/T/P/C: 0/0/4/2**
IV Year I Semester

Course Objectives:

1. Impart an adequate knowledge and expertise to calibrate instruments available in anIndustry.
2. Impart knowledge on various working principles and design of Instruments.
3. Understand calibration of measuring instruments for temperature.
4. Understand the functioning of strain gauges for measuring pressure, load and vibrations.
5. Apply calibration of measuring instruments of flow and speed measurement.

Course Outcomes:

1. Analyze errors, integrate and interpret different types of measurements
2. Review, prepare and present technological developments
3. Establish a course of action to solve problems
4. Illustrate load, flow, speed, vibration, temperature and pressure measurements.
5. Understand and analyze Instrumentation and Control systems and their applications ofvarious industries.

List of Experiments:

Task 1: Calibration of Pressure Gauge for pressure measurement

Task 2: Calibration of Thermistor for temperature measurement

Task 3: Study and Calibration of LVDT Transducer for displacement measurement

Task 4: Calibration of Strain Gauge for strain measurement

Task 5: Calibration of Thermocouple for temperature measurement

Task 6: Calibration of Capacitive Transducer for angular displacement measurement

Task 7: Study and Calibration of Photo and Magnetic speed pickups for measurement of speed.

Task8: Calibration of RTD (Resistance Temperature Detector) for temperature measurement.

Task 9: Study and Calibration of Rotameter for flow measurement

Task 10: Study and use of Vibrometer for the measurement of vibration amplitude at various loads

Task 11: Study and calibration of Mc Leod Gauge for low pressure measurement

Task 12: Calibration of Load Cell for load measurement

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPUTER AIDED ANALYSIS AND MANUFACTURING LAB

Course Code: GR20A4035 **L/T/P/C: 0/0/4/2**
IV Year I Semester

Course Objectives:

1. Simulation of one-dimensional structural problems
2. Simulation of two-dimensional structural problems
3. Solving problems in heat transfer and mechanics of materials
4. Gain the knowledge of CNC programming
5. Produce the machine components using CNC machines.

Course Outcomes:

1. Implement finite element method to design engineering components and solve engineering problems
2. Analyze 1-D and 2-D problems in solid mechanics and heat transfer
3. Perform model analysis on structures
4. Develop the CNC programs for turning and milling operations using basic codes and cycles
5. Create the components by performing the operations on CNC Turning and Milling machines.

List of experiments:

Task 1: Simulation of 1-D Structural Problem: Analysis of Truss members subjected to concentrated loads

Task 2: Simulation of 1-D Structural Problem: Analysis of Simply supported Beam subjected to concentrated load, bending moment, and uniform distributed load

Task 3: Simulation of 2-D Structural Problem: Analysis of Bracket subjected topressure load using plane stress conditions

Task 4: Simulation of 2-D Structural Problem: Analysis of Bracket subjected topressure load using symmetric boundary condition

Task 5: Simulation of 2-D Structural Problem: Analysis of Shaft subjected to pressureload using axisymmetric boundary conditions

Task 6: Thermal Problem 1: Thermal analysis of a Composite Slab

Task 7: Thermal Problem 2: Thermal analysis with conduction and convection boundary conditions

Task 8: Dynamics Problem 1: Model analysis of a beam

Task 9: Simulation and Execution of CNC program on turning machine using G70 ANDG71 Turning cycle

Task 10: Simulation and Execution of CNC program on Turning machine using G74drilling cycle, G75 grooving cycle, G76 threading cycle and G70 AND G71 Turning cycle

Task 11: Simulation and Execution of CNC program on Milling machine using G91surface milling cycle for given different profiles

Task 12: Simulation and Execution of CNC program on Milling machine – drilling holeson plate

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROJECT WORK - PHASE I

Course Code: GR20A4129 **L/T/P/C: 0/0/12/6**
IV Year I Semester

Course Objectives:

1. Demonstrate a wide range of skills learned to deliver a project.
2. Encourage multidisciplinary research through the integration learned.
3. Develop problem solving, analysis, synthesis and evaluation skills.
4. Encourage teamwork.
5. Improve communication and presentation skills during project work.

Course Outcomes:

1. Formulate hypothesis for the problem statement with sound technical knowledge from selected project domain.
2. Design Engineering Solution to the problem statement with systematic approach.
3. Analyse and develop an efficient solution for implementation of the project.
4. Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach.
5. Demonstrate professionalism with ethics while preparing and presenting the project work.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENVIRONMENTAL SCIENCE

Course Code: GR20A2001 **L/T/P/C: 2/0/0/2**

IV Year I Semester

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations
4. Integrate human ecology and science of environmental problems.
5. The effect of human activities on atmospheric pollution

Course Outcomes:

1. Understand the harmonious co-existence in between nature and human being
2. Recognize various problems related to environment degradation.
3. Develop relevant research questions for environmental investigation.
4. Generate ideas and solutions to solve environmental problems due to soil, air and water pollution.
5. Evaluate and develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development.

UNIT I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem resources and resilience, ecosystem value, services and carrying capacity.

UNIT II

Natural Resources: Classification of Resources: Living and Non-Living resources, natural capital & Resources water resources: use and over utilization of surface and ground water, conflicts over water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT III

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Waste waterTreatment methods: Primary, secondary and Tertiary.

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. Anthropogenic activities, influence on the occurrence of COVID-19 Pandemic? How environment benefitted due to global lockdown arising out of corona outbreak.

UNIT V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Life cycle analysis (LCA), Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Resource exploitation, Crazy Consumerism, Environmental Education, Environmental Ethics, Concept of Green Building.

TEXT BOOKS:

1. Environmental Studies by Anubha Kaushik, 4th Edition, New Age InternationalPublishers.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

REFERENCE BOOKS:

1. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
2. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
3. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela.2008 PHI Learning Pvt. Ltd.
4. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
5. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.
6. Environmental Studies by R. Rajagopalan, Oxford University Press.

IV Year

II Semester

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

RAPID PROTOTYPING AND TOOLING

Course Code: GR20A4100 **L/T/P/C: 3/0/0/3**

IV Year II Semester

Course Objectives:

1. Familiarize the basics of RPT
2. Study the modern prototyping tool Rapid prototyping, its types and applications.
3. Gain knowledge in various processes of RP
4. Understand the use of tooling in quick production
5. Understand the principles of Rapid tooling and reverse Engineering.

Course Outcomes:

1. Understand the concepts of rapid prototyping.
2. Understand the various processes of 3D printing processes
3. Apply FDM and LOM for complex parts manufacturing
4. Apply various RPT tools for quick manufacturing.
5. Apply 3D scanning for reverse engineering.

UNIT I

Introduction: Definitions, evolution, CAD for RPT. Product design and rapid product development. The cost and effects of design changes during conceptual modeling, detail designing, Prototyping, manufacturing and product release. Fundamentals of RPT technologies, Various CAD issues for RPT. RPT and its role in modern manufacturing mechanical Design. 3D solid modeling software and their role in RPT. Creation of STL or SLA file from a 3D solid model.

UNIT II

Liquid and powder based RP processes: Liquid based process: Principles of STL and typical processes such as the SLA process, solid ground curing and others - Powder based process: Principles and typical processes such as selective laser sintering and some 3D printing processes.

UNIT III

Solid based RP processes: Principles and typical processes such as fused deposition modeling, laminated object modeling and others.

UNIT IV

Rapid tooling: Principles and typical processes for quick batch production of plastic and metal parts though quick tooling.

UNIT V

Reverse engineering: 3D scanning, 3D digitizing and Data fitting, high speed machining- Hardware and software - Applications: Evaluation, bench marking and various case studies.

References:

1. Burns. M, “Automated Fabrication”, PHI, 1993.
2. Chua. C.K, “Rapid Prototyping”, Wiley, 1997.
3. Hilton. P.D. et al, “Rapid Tooling”, Marcel, Dekker 2000.
4. Beaman J.J et al, “Solid freeform fabrication”, Kluwer, 1997.
5. Jacohs P.F., “Stereolithography and other Rapid Prototyping and ManufacturingTechnologies”, ASME, 1996.
6. Pham D.T. and Dimov S.S., “Rapid Manufacturing; the tec

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SUSTAINABLE MANUFACTURING
(PROFESSIONAL ELECTIVE- V)

Course Code: GR20A4101 **L/T/P/C: 3/0/0/3**

IV Year II Semester

Course Objectives:

1. Inculcate the environmental valuation related to sustainable manufacturing.
2. Apply the concepts of evaluating sustainable manufacturing.
3. Develop the importance manufacturing strategy for sustainable manufacturing.
4. Provide the students with the knowledge of supply chain management techniques.
5. Identify the importance of sustainable operations in developing the product.

Course Outcomes:

1. Exhibit competence on the usage and applicability of sustainability techniques.
2. Apply the knowledge on various manufacturing strategy for sustainablemanufacturing.
3. Use the concept of supply chain management for the development of products.
4. Recommend suitable sustainable operations for the required application.
5. Analyze the various environmental valuation techniques related with sustainable manufacturing.

UNIT I

Environmental valuation: Introduction to the environmental issues pertaining to the manufacturing sector, Pressure to reduce Costs, Processes that minimize negative environmental impacts, Environmental legislation and Energy costs, Adoption of low carbon technologies, need to reduce the carbon footprint of manufacturing operations. Techniques for non-market valuation: Cost and Income based approaches, Demand estimation methods, Multi-criteria analysis, Stakeholder analysis.

UNIT II

Evaluating sustainability: Sustainability performance evaluators, Frameworks and techniques, Environmental management
Systems, Life cycle assessment, Strategic and environmental impact assessments, Carbon and water Foot-Printing.

UNIT III

Manufacturing strategy for sustainability: Concepts of Competitive Strategy, Manufacturing Strategies, Manufacturing strategy in business success Strategy formation and formulation, Structured strategy formulation, Sustainable manufacturing system designoptions, Approaches to strategy formulation, Realization of new strategies/system designs

UNIT IV

Supply chain management: Challenges in logistics and supply chain, developing the right supply chain strategy for the products, need to align the supply network around the strategy, Tools that can be used systematically to identify areas for improvement in supply chains, Specific challenges and new thinking in the plan, source and delivering of sub- processes.

UNIT V

Sustainable operations: Principles of sustainable operations - Life cycle assessment Manufacturing and service activities

Influence of product design on operations - Process analysis - Capacity management - Quality

management -Inventory management - Just-In-Time systems, Sustainable well-being and Consumerism.

Text Books:

1. Seliger, G ,"Sustainable Manufacturing: Shaping Global Value Creation", Springer,2012.
2. Seliger, G.,"Sustainability in Manufacturing: Recovery of Resources in Product and Material Cycles", 2007.
3. Jovane, F., Ęmper, W.E. and Williams, D. J., "The ManuFuture Road: Towards Competitive and Sustainable High-Adding-Value Manufacturing", Springer, 2009.

References:

1. Kutz, M.," Environmentally Conscious Mechanical Design", John Wiley and Sons,2007.
2. Davim, J.P., "Sustainable Manufacturing", John Wiley and Sons, 2010.
3. G. Atkinson, S. Dietz, E. Neumayer, — "Handbook of Sustainable Manufacturing". Edward Elgar Publishing Limited, 2007.
4. D. Rodick, "Industrial Development for the 21st Century: Sustainable Development Perspectives", UN New York, 2007.
5. Rogers, P.P., Jalal, K.F. and Boyd, J.A., "An Introduction to Sustainable Development", Earthscan, London, 2007.
6. S. Asefa, "The Economics of Sustainable Development", W.E. Upjohn Institute for Employment Research, 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUGMENTED REALITY AND VIRTUAL REALITY
(PROFESSINAL ELECTIVE -V)

Course Code: GR20A3067 **L/T/P/C: 3/0/0/3**

IV Year II Semester

Course Objectives:

1. To acquire the knowledge on augmented reality
2. To demonstrate the augmented reality devices.
3. To acquire the knowledge on virtual reality.
4. To illustrate the VR devices.
5. To explain how to apply VR/AR for various applications.

Course Outcomes:

1. To summarize about augmented reality.
2. To choose AR devices for various applications.
3. To summarize about augmented reality.
4. To experiment with VR devices.
5. To apply AR & VR technology in various domains.

UNIT I

What Is Augmented Reality? Where Did Augmented Reality Come From?, Augmented Reality, The Relationship Between Augmented Reality and Other Technologies, Augmented Reality Concepts, How Does Augmented Reality Work?, Ingredients of an Augmented Reality Experience.

UNIT II

Augmented Reality Hardware, Major Hardware Components for Augmented Reality Systems, Augmented Reality Software, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

UNIT III

Virtual Reality: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology, VR Becomes an Industry, The Five Classic Components of a VR System.

Input Devices: Trackers, Navigation, and Gesture Interfaces: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces.

UNIT IV

Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays: Graphics Displays, Sound Displays, Haptic Feedback.

Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society

UNIT V

Augmented Reality Applications, What Makes a Good Augmented Reality Application?, Application Areas, Magic Books, Magic Windows and Doors, Applying Augmented Reality to a Problem, Evaluating Augmented Reality Applications, VR Applications in Manufacturing, Applications of VR in Robotics.

Text books:

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications,Morgan Kaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

References:

1. LaValle " Virtual Reality" Cambridge University Press, 2016.
2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
4. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GAS DYNAMICS AND JET PROPULSIONS
(PROFESSIONAL ELECTIVE- V)

Course Code: GR20A4102 **L/T/P/C: 3/0/0/3**

IV Year II Semester

Course Objectives:

1. State the basic concept and importance of gas dynamics
2. Interpret the flow pattern in flow and non-flow systems
3. Understand of the Isentropic and non-isentropic flows
4. Understand of thermodynamic cycles of jet engines.
5. Analyze jet engines; determine propulsion efficiency and design inlets and nozzles.

Course Outcomes:

1. Explain basic concepts of gas dynamics and describe the basic fundamental equationsof one-dimensional flow of compressible fluid and isentropic flow of an ideal gas.
2. Analyze the steady one-dimensional is entropic flow, frictional flow and isothermalflow and express the concepts of steady one-dimensional flow with heat transfer.
3. Discuss the effect of heat transfer on flow parameters.
4. Describe the jet propulsion engines
5. Describe the basic concepts of rocket propulsion

UNIT I

Compressible flow, definition, Mach waves and Mach cone, stagnation states Mass, momentum and energy equations of one-dimensional flow

UNIT II

Isentropic flow through variable area ducts, nozzle s and diffusers, subsonic and supersonic flow I variable area ducts, choked flow, Area-Mach number relations for isentropic flow.

UNIT III

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables

UNIT IV

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines.

UNIT V

Types of rocket engines, propellants AND feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, spaceflights.

Text Books:

1. Ahmed F. El-Sayed, Aircraft Prpoulsion and Gas Turbine Engines, CRC Press, 2008.
2. H.S. Mukunda,“ Understanding Aerospace Chemical Propulsion” , InterlinePublishing, 2004.
3. Hill P. and Peterson C., Mechanics and Thermodynamics of Propulsion, AddisonWesley, 1992.
4. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I and II, John Wiley, 1975.

Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
UN-CONVENTIONAL MACHINING PROCESSES
(PROFESSIONAL ELECTIVE- V)

Course Code: GR20A4103 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Objectives:

1. Identify the classification of unconventional machining processes.
2. Understand the principle, mechanism of metal removal of various unconventional machining processes.
3. Understand the applications of different processes.
4. Study the various process parameters and their effect on the component machined onvarious unconventional machining processes.
5. Study of optimization of process parameters

Course Outcomes:

1. Understanding and application of advanced machining processes for major technical and economic advantages over conventional processes.
2. Knowledge on application of adoptive control to these UCM processes and in process inspection techniques to wider there area of use.
3. Application of machine tools equipped with a computer controls for higher reliability, better repeatability and higher accuracy.
4. Utilization of energy in its direct form for machining of difficult to machine materials in turbines and automobiles.
5. Knowledge on application on UC machining processes for precision machining and ultra precision machining techniques, where by the material is removed in form of atoms or molecules individually or groups.

UNIT I

Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials Applications.

UNIT II

Mechanical processes: Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT III

Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations. Magnetic abrasive finishing, Abrasive flow finishing.

UNIT-IV

Thermo electric processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications. Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining –thermal features, cutting speed and accuracy of cut. Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

UNIT V

Electro chemical & chemical processes: Fundamentals of electrochemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate, Electro stream drilling, Shaped tube electrolytic machining. Fundamentals of chemical machining, Chemical machining principle, maskants, etchants, advantages and applications of chemical machining. Metal removal rate, Electro stream drilling, Shaped tube electrolytic machining. Fundamentals of chemical machining, Chemical machining principle, maskants, etchants, advantages and applications of chemical machining.

Text books:

1. Advanced machining processes by VK Jain/ Allied publishers.

References:

1. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.
2. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.
3. Modern Production / Operations Management / Baffa & RakeshSarin.
4. Operations Management – S.N. Chary.
5. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
6. Reliability Engineering & Quality Engineering by Dr. C. Nadha Muni Reddy and Dr.
7. K. Vijaya Kumar Reddy, Galgotia Publications, Pvt., Limited.
8. Production Control A Quantitative Approach / John E. Biegel.
9. Production Control / Moore.
10. Operations Management / Joseph Monks.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRODUCTION PLANNING AND CONTROL
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR20A4104 **L/T/P/C: 3/0/0/3**

IV Year II Semester

Course Objectives:

1. Facilitate the understanding of Production Planning and Control in manufacturing and service organizations
2. Develop an understanding on forecasting techniques for effective real life applications
3. Provide a brief review of routing and scheduling techniques and to understand the factors affecting scheduling
4. Provide an understanding on scheduling policies and scheduling methods and toexamine several aggregate planning methods
5. Provide an understanding on dispatching its procedures and follow up.

Course Outcomes:

1. Develop an understanding on objectives, functions, applications of ProductionPlanning and Control
2. Develop in-depth knowledge on various techniques of forecasting both Qualitative and Quantitative
3. Critically assess the routing and scheduling techniques and to understand the factorsthat are affecting scheduling process
4. Analyze the problems in Line Balancing and the methods of aggregate planning
5. Develop analytical skills for investigating and analyzing production planning and control in the industry and suggest implementable solutions.

UNIT I

Introduction: Definitions- objectives of production on planning and control- function of production planning and control- elements of production control- types of production – organization of production planning and control – internal organizations of department.

UNIT II

Forecasting: Importance of forecasting – types of forecasting, their uses – general principles of forecasting techniques- Qualitative methods and quantitative methods MRP: Introduction to MRP and ERP, LOB (Line Of Balance). JIT – Japanese concepts.

UNIT III

Routing and Scheduling: Routing- Definition – routing procedure – Route sheets – Bill of material – factors affecting routing procedure, Schedule – definition – difference with loading, Factors affecting scheduling.

UNIT IV

Scheduling: Scheduling policies – techniques, standard scheduling methods- job shop, flow shop. Line balancing, aggregate planning – methods for aggregate planning – Chase planning,expediting, control aspects.

UNIT V

Activities of dispatcher – Dispatching procedure – follow up – definition – reasons for existence of functions – types of follow up, applications of computer in production planningcontrol.

Text books:

1. Production Planning and Control-M.Mahajan –Dhanpatirai and Co.
2. Production Planning and Control – Jain and Jain – Khanna publications

References:

1. Production Planning and Control – Text and cases/ SK Mukhopadhyaya/PHI.
2. Production Planning and Control – R.PaneerSelvam – PHI
3. Operations Management by Chase/PHI
4. Management Science- A R Aryasri-4e-TMH
5. Operations management – Heizer – Pearson

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER PLANT ENGINEERING
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR20A4106 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Objectives:

1. Memorize the Thermal Power Plant Operation, different types of high pressure boilersincluding supercritical and supercharged boilers, Fluidized bed combustion systems
2. Implement the factors which influence in Design the components of gas turbine plantand IGCC Systems
3. Explain the Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
4. Describe of the operation of Hydroelectric, wind, solar PV, solar thermal, geothermal, biogas and fuel cell power systems.
5. Interpret the Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc. and discussing environmental and safety aspects of power plant operation.

Course Outcomes:

1. Demonstrate knowledge of thermal power plant and its working procedure with thecomplete plant layout.
2. Identify and apply fundamentals to solve problems like performance of gas turbine andIGCC power plant systems
3. List the principal components and types of nuclear reactors.
4. Classify various Hydroelectric power plants and its auxiliaries
5. Explain the concepts of power plant economics and impact of its effluents onenvironment

UNIT I

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

UNIT II

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

UNIT III

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), Gas Cooled and Liquid Metal Cooled Reactors, safety measures for nuclear power plants.

UNIT IV

Hydroelectric power plants, classification, typical layout and components, construction and working, principles of wind, tidal, solar Photo Voltaic and solar thermal, geothermal, biogas and fuel cell power systems.

UNIT V

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGrawHill, 1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BLOCK CHAIN TECHNOLOGY
(PROFESSINAL ELECTIVE- VI)

Course Code: GR20A3135 **L/T/P/C:3/0/0/3**
IV Year II Semester

Course Objectives:

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into their own projects.
5. Explaining design principles of Bitcoin and Ethereum and Nakamoto consensus.

Course Outcomes:

1. Learn the Simplified Payment Verification protocol.
2. List and describe differences between proof-of-work and proof-of-stake consensus.
3. Interact with a blockchain system by sending and reading transactions.
4. Design, build, and deploy a distributed application.
5. Evaluate security, privacy, and efficiency of a given blockchain system.

UNIT I

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. • Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT IV

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT V

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Tutorial & Practical: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles.

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies

Reference Books:

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks onEthereum smart contracts

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROJECT WORK - PHASE II

Course Code: GR20A4130 **L/T/P/C:0/0/12/6**
IV Year II Semester

Course Objectives:

1. Demonstrate a wide range of skills learned to deliver a project.
2. Encourage multidisciplinary research through the integration learned.
3. Develop problem solving, analysis, synthesis and evaluation skills.
4. Encourage teamwork.
5. Improve communication and presentation skills during project work.

Course Outcomes:

1. Formulate hypothesis for the problem statement with sound technical knowledge from selected project domain.
2. Design Engineering Solution to the problem statement with systematic approach.
3. Analyse and develop an efficient solution for implementation of the project.
4. Apply the theoretical concepts while providing solution to the problem statement with teamwork and multidisciplinary approach.
5. Demonstrate professionalism with ethics while preparing and presenting the project work.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECCHNOLOGY

SOFT SKILLS AND INTERPERSONALSKILLS
(OPEN ELECTIVE)

Course code: GR20A3136 **L/T/P/C: 3/0/0/3**

Course Objectives:

1. To know the importance of soft skills.
2. To identify good leadership skills /qualities.
3. To recognize the importance of interpersonal skills.
4. To demonstrate the significance of confidence building.
5. To define and differentiate between a report and a proposal.

Course Outcomes:

1. Develop soft skills communication skills, leadership skills etc.
2. Implement goal setting techniques to build a promising career.
3. Design formal report and proposals with appropriate formal expressions.
4. Create healthy workplace environment by treating others with respect and dignity.
5. Evaluate the power of confidence building and self-esteem with examples.

UNIT I

Soft Skills

- Introduction to soft skills, Definition of Soft skills, Importance of soft skills
- Communication skills, Usage of English in Business/Corporate scenario
- Nonverbal communication - Proxemics
- Presentation skills

UNIT II

Team Building & Leadership Qualities

- Qualities of a good leader
- Problem solving and Decision Making
- Strategic management
- Crisis management

UNIT III

Personality Development

- Motivation
- Goal setting
- Self-esteem
- Team skills

UNIT IV

Developing Reports and Proposals

- Understanding reports and proposals
- Planning reports and proposals
- Writing beginning, body and ending
- Formats of reports and proposals

UNIT V

Interpersonal Skills

- Understanding professional relationships
- Networking professionally
- Showing basic office courtesies
- Interview skills

Text books:

1. Soft Skills-Key to success in workplace and life
2. Meenakshi Raman, Raman Upadhyay, CENAGE

Reference books:

1. Soft skills for Everyone - Jeff Butterfield, CENAGE Learning
2. Soft skills for Interpersonal Communication - S.Balasubramaniam (ORIENTBLACKSWAN)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR
(OPEN ELECTIVE)

Course Code: GR20A3137 **L/T/P/C:3/0/0/3**

Course Objectives:

1. OB provides perspectives and skills that enhance understanding of our own behaviourand our ability to influence the behaviour of others in organizational settings
2. OB and HRM together can instill sustainability deep within an organizations' culture.
3. To equip them with behavioural skills in managing people at work.
4. To make student aware of the concepts, techniques and practices of human resourcedevelopment.
5. This course is intended to make students capable of applying the principles and techniques as professionals for developing human resources in an organization.

Course Outcomes:

1. To acquaint the student with the determinants of intra -individual, inter-personnel and inter-group behaviour in organisational setting.
2. To understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories and apply in the organizational context.
3. To assess the group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations in the framework of organization and to familiarize the concepts, techniques and practices of human resource development in the current organizational view.
4. To impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
5. To report the current trends and applications in HRD and Balanced Scorecard to measures the performance and to develop, implement, and evaluate organizational human resource development strategies aimed at promoting organizational effectiveness in different organizational environments.

UNIT I

Introduction to OB: Organisational Behaviour- Concept and Emergence of OB Concept; Nature and Theoretical frameworks; Models of Organisational Behaviour, Challenges and Opportunities for Organisational Behavior;

UNIT II

Individual Behaviour: Individual Behaviour: Personality, Learning, Values and Attitudes, Perception, Stress at work. Management's assumptions about people- McGregor's Theory X and Theory Y. Motivation - Maslow's Need Hierarchy, Herzberg's Two Factors Theory, Vroom's Expectancy Theory.

UNIT III

Inter-personal and Group Behaviour: Interpersonal communication and Feedback; Transactional Analysis (TA); Johari Window. Group Behaviour: Group Dynamics, Cohesiveness and Productivity; Management of Dysfunctional groups; Group Decision Making. Leadership- Concept and Styles.

UNIT IV

Introduction to Human Resource Development: Concept; Relationship between human resource management and human resource development; HRD mechanisms, processes and outcomes; HRD matrix; Roles and competencies of HRD professionals; Challenges in HRD, steps in HRD Process.

UNIT V

HRD Applications and Trends: Coaching and mentoring; Career management and development; Competency mapping; Balanced Score Card. HRD in Organisations: Selected cases covering HRD practices in government organisations, manufacturing and service industries and MNCs.

Text Books:

1. Robbins, Stephen P. and Timothy A. Judge, Organisational Behaviour, Prentice -Hall,New Delhi.
2. Werner J. M., DeSimone, R.L., Human resource development, South Western.

Reference Books:

1. Luthans, Fred, Organizational Behaviour, McGraw-Hill, New York.
2. Gregory, Moorhead and Ricky W. Griffin, Managing Organizational Behaviour,Thomson South Western Publication.
3. Pareek, Udai and V. Sisodia, “HRD in the New Millennium, Tata McGraw - HillPublishing Co. Ltd., New Delhi, 1999.
4. Haldar, U. K., Human resource development, Oxford University Press India.
5. Rao, T.V., Future of HRD, Macmillan Publishers India.
6. Rao, T.V., HRD Score Card 2500: Based on HRD audit, Response Books, SAGEPublications.
7. Mankin, D., Human resource development, Oxford University Press India.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CYBER LAW AND ETHICS
(OPEN ELECTIVE)

Course Code: GR20A3138 **L/T/P/C: 3/0/0/3**

Course Objectives:

1. The course objective is to provide the fundamental skill to understand cyber laws.
2. It enable to understand the legal frameworks
3. It helps the student understand different cyber crimes
4. It provides overview on Intellectual Property, copy rights, patents rights etc.
5. Given rapid changes in technology and the corresponding changes in crime and thelaw

Course Outcomes:

1. Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Students locate and apply case law and common law to current legal dilemmas in the technology field.
3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Students will be able understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. The student will be in position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

UNIT I

The Legal System: Sources of Law and The Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court), Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II

Introduction cyber law: Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level.

UNIT III

Constitutional & Human Rights Issues in Cyber space : Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace, Access to Internet, Right to Privacy, Right to Data Protection.

UNIT IV

Cyber Crimes & Legal Framework: Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under IT Act

UNIT V

Intellectual Property Issues in Cyber Space: Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Text books:

1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012)
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
4. Jonthan Rosenoer, Cyber Law, Springer, New York, (1997).
5. Sudhir Naib, The Information Technology Act, 2005: A Handbook.
6. S. R. Bhansali, Information Technology Act, 2000 University Book House Pvt. Ltd. Jaipur (2003).
7. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ECONOMIC POLICIES IN INDIA
(OPEN ELECTIVE)

Course Code: GR20A3139 **L/T/P/C:3/0/0/3**

Course Objectives:

1. To analyze the overall business environment and evaluate its various components in business decision making.
2. To provide an analysis and examination of significant contemporary ethical issues and challenges.
3. To Emphases the manager's social and environmental responsibilities to a widevariety of stakeholders.
4. To know the various Government policies governing industry.
5. To know economic terms and its scope.

Course Outcomes:

1. Familiarize with the nature of business environment and its components.
2. The students will be able to demonstrate and develop conceptual framework ofbusiness environment.
3. Understand the definition of ethics and the importance and role of ethical behaviour inthe business world today.
4. Explain the effects of government policy on the economic environment.
5. Outline how an entity operates in a business environment.

UNIT I

Business environment-factors effecting Business Environment-need for industrial policies, Overview of Indian Economy, Trends towards market economy, problems of underdevelopment – meaning, Main problems, reasons, of underdevelopment.

UNIT II

Factors and measure, Meaning of Economic development, National income, Percapital income, Quality of life, Capital Formation – Savings, Investment.

UNIT III

NITI Aayog and Planning in India, Niti Aayog and its function, how is Niti Aayog different from planning commission, Meaning, Importance, Main reasons of adopting, planning in India, Objectives of planning, Economic development, moderation, stability, self-sufficiency, employment etc., foreign aid, Employment. Allocation of Resources

UNIT IV

Private and Public Sector, Public Sector – role and growth, Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

UNIT V

Present Economic Policy, Main feature, Globalization, Expansion of Private sector, more market orient approach. Public distribution system, Industrial policies before and after 1991, Industrial Licensing, Monetary and Fiscal Policy, elements of Indian current GDP and review of current budget.

Text books

1. Francis Cherunilam: Business Environment: Text and Cases. 18/e. Himalaya. 2009.
2. Misra and Puri: Indian Economy, Himalaya, 2009.

References:

1. Indian Economy- A. N. Agarwal
2. Indian Economy – Mishra &Puri
3. Indian Development and planning – M. L. Jhingan
4. Indian Economy – R. S. Rastogi Yozna and Kurukshetra Maga