Academic Regulations
Programme Structure
&
Detailed Syllabus

Bachelor of Technology
(B. Tech)
(Four Year Regular Programme)
(Applicable for Batches admitted from 2018)

Department of Mechanical Engineering

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING & TECHNOLOGY
Bachupally, Kukatpally, Hyderabad, Telangana, India
500 090

Academic Regulations

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
DEPARTMENT OF MECHANICAL ENGINEERING (B. Tech)
GR18 REGULATIONS

Gokaraju Rangaraju Institute of Engineering and Technology 2018 Regulations (GR18 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Mechanical Engineering with effect from the students admitted to the programmes in 2018-19 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/Universityor 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 is 160.
   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	Course Description
1	BSC	Basic Science Courses	Basic Science Courses
2	ESC	Engineering Science Courses	Includes Engineering subjects
3	HSMC	Humanities and Social sciences	Includes Management courses
4	PCC	Professional Core Courses	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	PEC	Professional Elective Courses	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6	OEC	Open Elective Courses	Electives from other technical and/or emerging subjects
7	LC	Laboratory Courses	Laboratory Courses
8	MC	Mandatory Courses	Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge
9	PROJ	Project Work	Project work, seminar and internship in industry or elsewhere

5. **Award of B. Tech Degree:** A student will be declared eligible for the award of 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 Mechanical 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 be condoned.

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 conducted for 20 marks each for a duration of 2 hours. Average of the two mid exams shall be considered **i) Subjective - 15 marks** **ii) Objective - 5 marks** **2) Tutorials - 5 marks** **3) Continuous Assessment – 5 marks**
		70	Semester end examination	The semester-end examination is for a duration of 3 hours
2	Practical	30	Internal Examination & Continuous Evaluation	**i) Internal Exam-10 marks** **ii) Record - 5 marks** **iii) Continuous Assessment - 15 marks**
		70	Semester end examination	The semester-end examination is for 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.

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 marksshall be for internal evaluation and 70 marksfor 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 Phase II.

g) Engineering Graphics:

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

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 credits can appear for 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 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	**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 second semester.** **(ii) Must have secured at least 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student 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 second year second semester** **(ii) Must have secured at least 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student 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 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.**
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 grades and percentage 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.,

$$\text{SGPA } (S_k) = \sum^{n}{}_{i=1} (Ci * Gi) / \sum^{n}{}_{i=1} Ci$$

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 ≥ 2.

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

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 the 160 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 withheld 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 GR18
(Applicable for Batches Admitted from 2019-2020)

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 123 credits and secure all credits. The marks obtained in all 123 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 or not.**
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 ofthe 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 123 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**

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090, India. (040) 6586 4440

MECHANICAL ENGINEERING

I YEAR I SEMESTER

S.NO.	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A1001	Linear Algebra and Differential Calculus	3	1	0	4	4	30	70	100
2	GR18A1004	Engineering Physics	3	1	0	4	4	30	70	100
3	GR18A1007	Programming for Problem Solving	3	1	0	4	4	30	70	100
4	GR18A1010	Engineering Graphics	1	0	4	5	3	30	70	100
5	GR18A1012	Engineering Physics Lab	0	0	3	3	1.5	30	70	100
6	GR18A1015	Programming for Problem Solving Lab	0	0	3	3	1.5	30	70	100
		Induction Programme								
Total			**10**	**3**	**10**	**23**	**18**	**180**	**420**	**600**

I YEAR II SEMESTER

.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A1002	Differential Equations and Vector Calculus	3	1	0	4	4	30	70	100
2	GR18A1005	Engineering Chemistry	3	1	0	4	4	30	70	100
7	GR18A1009	Engineering Mechanics	3	1	0	4	4	30	70	100
4	GR18A1006	English	2	0	0	2	2	30	70	100
5	GR18A1013	Engineering Chemistry Lab	0	0	3	3	1.5	30	70	100
6	GR18A1014	English Language and Communication Skills Lab	0	0	2	2	1	30	70	100
7	GR18A1017	Engineering Workshop	1	0	3	4	2.5	30	70	100
Total			**12**	**3**	**8**	**23**	**19**	**210**	**490**	**700**

II YEAR I SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A2036	Introduction to Electromagnetic Theory	3	0	0	3	3	30	70	100
2	GR18A2037	Materials Engineering	3	0	0	3	3	30	70	100
3	GR18A2038	Basic Electrical and Electronics Engineering	3	0	0	3	3	30	70	100
4	GR18A2039	Strength of Materials	3	0	0	3	3	30	70	100
5	GR18A2040	Thermodynamics	3	0	0	3	3	30	70	100
6	GR18A2041	Machine and Production Drawing	0	0	6	6	3	30	70	100
7	GR18A2042	Strength of Materials Lab	0	0	3	3	1.5	30	70	100
8	GR18A2043	Materials Science and Metallurgy Lab	0	0	3	3	1.5	30	70	100
Total			**15**	**0**	**12**	**27**	**21**	**240**	**560**	**800**
9	GR18A2001	Environmental Science	2	0	0	2	2	30	70	100

II YEAR II SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1	GR18A2044	Applied Thermodynamics	3	1	0	4	4	30	70	100
2	GR18A2045	Fluid Mechanics and Fluid Machines	3	0	0	3	3	30	70	100
3	GR18A2046	Kinematics of Machinery	3	1	0	4	4	30	70	100
4	GR18A2005	Probability and Statistics	3	0	0	3	3	30	70	100
5	GR18A2047	Manufacturing Process	3	0	0	3	3	30	70	100
6	GR18A2048	Thermal Engineering Lab	0	0	3	3	1.5	30	70	100
7	GR18A2049	Manufacturing Process Lab	0	0	3	3	1.5	30	70	100
8	GR18A2050	Fluid Mechanics and Fluid Machines Lab	0	0	3	3	1	30	70	100
Total			**15**	**2**	**9**	**26**	**21**	**240**	**560**	**800**
9	GR18A2003	Constitution of India	2	0	0	2	2	30	70	100

III YEAR I SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1		Machine Design	3	0	0	3	3	30	70	100
2		Dynamics of Machinery	3	0	0	3	3	30	70	100
3		Heat Transfer	3	0	0	3	3	30	70	100
4		Economics and Accounting for Engineers	3	0	0	3	3	30	70	100
5		Manufacturing Technology	3	0	0	3	3	30	70	100
6		Professional Elective I	3	0	0	3	3	30	70	100
7		Computer Aided Design Lab	0	0	3	3	1	30	70	100
8		Manufacturing Technology Lab	0	0	3	3	1	30	70	100
9		Heat Transfer Lab	0	0	3	3	1	30	70	100
Total			**18**	**0**	**9**	**27**	**21**	**270**	**630**	**900**

III YEAR II SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1		CAD/CAM	3	0	0	3	3	30	70	100
2		Design of Machine Elements	3	0	0	3	3	30	70	100
3		Fundamentals of Management and Entrepreneurship	3	0	0	3	3	30	70	100
4		Professional Elective II	3	0	0	3	3	30	70	100
5		Open Elective I	3	0	0	3	3	30	70	100
6		Modeling and Analysis Lab	0	0	3	3	1.5	30	70	100
7		Design Engineering Lab	0	0	3	3	1.5	30	70	100
8		Mini Project with Seminar	0	0	6	6	3	30	70	100
		Summer Internship	-	-	-	-	-			
Total			**15**	**0**	**12**	**27**	**21**	**240**	**560**	**800**
9		Value Ethics and Gender Culture	2	0	0	2	2	30	70	100

IV YEAR I SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1		Instrumentation and Control Systems	2	0	0	2	2	30	70	100
2		Metrology and Surface Engineering	3	0	0	3	3	30	70	100
3		Professional Elective III	3	0	0	3	3	30	70	100
4		Professional Elective IV	3	0	0	3	3	30	70	100
5		Open Elective II	3	0	0	3	3	30	70	100
6		Metrology & Instrumentation Lab	0	0	2	2	1	30	70	100
7		Project work (Phase I)	0	0	12	12	6	30	70	100
Total			**14**	**0**	**14**	**28**	**21**	**210**	**490**	**700**

IV YEAR II SEMESTER

S.NO	Course Code	COURSE	Hours			Total Hours	Total Credits	Int	Ext	Marks
			L	T	P					
1		Automation in Manufacturing	3	0	0	3	3	30	70	100
2		Professional Elective V	3	0	0	3	3	30	70	100
3		Professional Elective VI	3	0	0	3	3	30	70	100
4		Open Elective III	3	0	0	3	3	30	70	100
5		Project work (Phase II)	0	0	12	12	6	30	70	100
Total			**12**	**0**	**12**	**24**	**18**	**150**	**350**	**500**

PROFESSIONAL ELECTIVES – 4 THREADS

MANUFACTURING	DESIGN	THERMAL	AUTOMATION

Mechatronic Systems	Solid Mechanics	IC Engines	Principles Of Management
Composite Materials	Design for Manufacturing	Refrigiration And Air Conditioning	Microprocessor In Automation
Finite Element Analysis	Computer Aided Design	Computational Fluid Dynamics	Optimization Techniques
Process Planning And Cost Estimation	Tribology	Automobile Engg.	Computer Aided Manufacturing
Robotics	Design Of Transmission Systems	Gas Dynamics And Jet Propulsions	Production Planning And Control
Flexible Manufacturing Systems	Mechanical Vibrations	Power Plant Engineering	Total Quality Management

OPEN ELECTIVES – 2 THREADS

S. No.	THREAD 1	THREAD 2
1	Soft Skills and Interpersonal Communication	CSE: 1. E-Commerce 2. Database Management Systems 3. Java Programming
2	Human Resource Development and Organizational Behaviour	IT: 1. Multimedia and Application Development 2. Web Programming 3. Operating Systems
3	Cyber Law and Ethics	EEE: 1.Embedded Systems 2. Control Systems 3. Artificial Intelligence Techniques
4	History of Science	ECE: 1. Principles of Satellite Communications 2. Scientific Computing 3. Wavelets
5	Introduction to Art and Aesthetics	ME: 1.Operations Research 2. Automobile Engineering 3. Robotics
6	Economic Policies in India	CE: 1. Green Building Technology 2.Building Materials and Construction Planning 3. Introduction to Fluid Mechanics

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA AND DIFFERENTIAL CALCULUS

Course code: GR18A1001 **L/T/P/C: 3/1/0/4**

Course Objectives: To provide the student with

- The ideas of linearity and linear systems, which lie at the core of many engineering concepts.
- The concept of latent values of a matrix which is critical in many engineering applications.
- The ideas of function approximation using the tools of mean value theorems.
- The skill of using a definite integral for various geometrical applications.
- The skill of finding the optimal values of multi-variable functions.

Course Outcomes: After learning the contents of this paper the student must be able to

- Compute the rank of a matrix to determine the existence of solutions of a linear algebraic system.
- Determine the eigenvalues and eigenvectors of a square matrix which arise in several engineering applications.
- Determine approximate solution of over determined systems using the pseudo inverse.
- Apply the definite integral for various computational problems in geometry and Evaluate some improper integrals using special functions.
- Develop the skill of determining optimal values of multivariable functions using classical methods.

Unit I: VECTOR AND MATRIX ALGEBRA

Vector space (definition and examples), linear independence of vectors, orthogonality of vectors, projection of vectors, Gram-Schmidt ortho normalization of vectors, Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and UNIT-ary 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 eigenvalues 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 forms by orthogonal transformation.

Unit III: MATRIX DECOMPOSITION AND PSEUDO INVERSE OF A MATRIX

Spectral decomposition of a symmetric matrix, L-U decomposition, 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: SINGLE VARIABLE CALCULUS

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem and Taylor's theorem (without proof), their geometrical interpretation and applications, approximation of a function by Taylor's series, Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (only in Cartesian coordinates), Evaluation of improper integral using Beta and Gamma functions.

Unit V: 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

Text/Reference Books:

1. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa publishing house,
2. Fourth edition 2014
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thedition,Pearson, Reprint,
5. 2002.
6. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
7. GRIET reference manual.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING PHYSICS

Course code: GR18A1004 **L/T/P/C: 3/1/0/4**

Course Objectives: At the end of the course the student is expected to

- Demonstrate skills in scientific inquiry and problem solving techniques.
- Illustrate the wave nature of light through the phenomena of interference and diffraction.
- Interpret the properties of Laser light and its uses in optical fiber communication.
- Classify and analyze the properties of solid and engineered semiconductor materials.
- Demonstrate competence and understanding of the concepts of Harmonic oscillations and waves.

Course Outcomes: At the completion of this course, students will be able to:

- Apply the phenomenon of interference and diffraction of waves.
- Analyze the properties of Laser and its propagation in optical fibers.
- Classify materials based on free electron theory.
- Extend the knowledge of characterization techniques to know the composition of Nano material.
- Describe the quality factor for damped mechanical and electrical oscillators.

Unit I: WAVE OPTICS

Huygens's principle, 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, Michelson's interferometer, Fraunhofer diffraction from a single slit, double slit and N slits, Diffraction grating: Grating spectrum and resolving power.

Unit II: LASERS AND FIBER OPTICS

Lasers: Interaction of radiation with matter: Spontaneous and Stimulated emission and absorption, Einstein coefficients, Characterizes of lasers, Resonating cavity, Active medium, pumping, population inversion, Construction and working of laser: Ruby laser, He-Ne laser, application of lasers.

Fiber Optics: Introduction, Principle and Construction of an optical fiber, Acceptance angle, Numerical aperture, Types of Fibers, losses associated with optical fibers, Basic components in optical fiber communication system, Application of optical fibers.

Unit III: INTRODUCTION TO SOLIDS

Free electron theory of metals, Classical and quantum free electron theory, Density of states, Dependence of Fermi level on temperature, Bloch's theorem, Kronig – Penny model(Qualitative treatment), E – K diagram, origin of energy bands, Classification of materials on the basis of energy bands, Effective mass.

Unit IV: ENGINEERED SEMICONDUCTOR MATERIALS

Nanomaterials: Introduction, quantum confinement, surface to volume ratio, density of states in 2D, 1D and 0D (qualitatively), Practical examples of low-dimensional systems such as quantum wells, wires and dots.

Fabrication: Top-Down by CVD, Bottom –Up by Sol-Gel and characterization techniques: SEM, TEM and EDAX.

Unit V: HARMONIC OSCILLATIONS

Mechanical oscillators: Differential equation of simple harmonic motion, Phase relationship between displacement, velocity and acceleration, energy of a harmonic oscillator, damped harmonic oscillator: heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor. Electrical oscillators: L-C Circuit.

Text/Reference 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. Ajoy Ghatak, "Optics", McGraw Hill Education, 2012
7. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006
8. O. Svelto, "Principles of Lasers"
9. "Introduction to Mechanics", M.K.Verma, Universities Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING

Course Code: GR18A1007 **L/T/P/C: 3/1/0/4**

Prerequisite: Knowledge of Mathematics required.

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Outcomes:

The Student will learn

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in C programming language.
- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.

Unit I: INTRODUCTION TO PROGRAMMING

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program, Number systems

Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code , Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops

I/O: Simple input and output with scanf and printf, formatted I/O.

Unit II: ARRAYS, STRINGS, STRUCTURES AND POINTERS

Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays

Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures.

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self referential structures in linked list (no implementation)Enumeration data type

Unit III: PREPROCESSOR AND FILE HANDLING IN C

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

Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions. Introduction to stdin, stdout and stderr.

Unit IV: FUNCTION AND DYNAMIC MEMORY ALLOCATION

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series, Limitations of Recursive functions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

Unit V: INTRODUCTION TO ALGORITHMS

Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number, Basic searching in an array of elements (linear and binary search techniques),Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

Text/ Reference 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, (3^{rd} Edition)**:**
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice
4. Hall of India
5. R.G. Dromey, How to solve it by Computer, Pearson (16^{th} Impression)
6. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
7. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4^{th} Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERINGGRAPHICS

Course Code: GR18A1010 **L/T/P/C: 1/0/4/3**

Course Objectives:

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

Course Outcomes:

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

Unit I: INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their Significance, Conic Sections including Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain and Diagonal.

Unit II: ORTHOGRAPHIC PROJECTIONS

Principles of Orthographic Projections, Conventions, Projections of Points and Lines, Projections of Plane regular geometric figures-Auxiliary Planes.

Unit III: PROJECTIONS OF REGULAR SOLIDS

Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

Unit IV: DEVELOPMENT OF SURFACES OF RIGHT REGULAR SOLIDS

Prism, Cylinder, Pyramid and Cone, Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

Unit V: ISOMETRIC PROJECTIONS

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
2. Engineering Drawing/ N.S.Parthasarathy and Vela Murali/Oxford
3. EngineeringGraphics.ByBasanthAgrawal/CMAgrawal/McGrawHillEducation
4. Engineering Drawing by K.VenuGopal/New Age Publications.
5. Computer Aided Engineering Drawing / K Balaveera reddy et al-CBS publishers
6. Engineering Graphics and Design by Kaushik Kumar / Apurbakumar Roy / Chikesh Ranjan

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING PHYSICS LAB

Course Code: GR18A1012 **L/T/P/C: 0/0/3/1.5**

Course Objectives: At the end of the course the student is expected to

- Experiment with resonance phenomena using electrical source.
- Recall the basic properties of light like interference and diffraction through hands on experience.
- Apply the theoretical concepts of optical fibers in practical application.
- Analyze the mechanical properties of solid materials.
- Analyze the behavior of semiconductors in various aspects.

Course Outcomes: At the completion of this course, students will be able to

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

LIST OF EXPERIMENTS:

TASK 1: Melde's experiment: To determine the frequency of a vibrating bar or turning fork using Melde's arrangement.

TASK 2: Torsional pendulum: To determine the rigidity modulus of the material of the given wire using Torsional pendulum.

TASK 3: Newton's rings: To determine the radius of curvature of the lens by forming Newton's rings.

TASK 4: Diffraction grating: To determine the number of lines per inch of the grating.

TASK 5: Dispersive power: To determine the dispersive power of prism by using spectrometer.

TASK 6: Coupled Oscillator: To determine the spring constant by single coupled oscillator.

TASK 7: LCR Circuit: To determine quality factor and resonant frequency of LCR circuit.

TASK 8: LASER: To study the characteristics of LASER sources.

TASK 9: Optical fiber: To determine the Numerical aperture and bending losses of Optical fibers.

TASK 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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: GR18A1015 **L/T/P/C: 0/0/3/1.5**

Prerequisite: Basic operations of computer and knowledge of mathematics

Laboratory Objectives: The students will learn the following

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

Laboratory Outcomes: The candidate is expected to be able to

- Formulate the algorithms for simple problems and translate given algorithms to a working and correct program.
- Correct syntax errors as reported by the compilers
- Identify and correct logical errors encountered during execution
- Represent and manipulate data with arrays, strings and structures and use pointers of different types
- 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: (Practice sessions)

a. Write a simple program that prints the results of all the operators available in C (including pre/ post increment, bitwise and/or/not, etc.). Read required operand values from standard input.
b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values form standard input.

Task 2: (Simple numeric problems)

a. Write a program for fiend the max and min from the three numbers.
b. Write the program for the simple, compound interest.
c. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.

Task 3: (Simple numeric problems)

a. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
    i. 5 x 1 = 5

ii. 5 x 2 = 10
iii. 5 x 3 = 15

b. Write a program that shows the binary equivalent of a given positive number between 0 and 255.

Task 4: (Expression Evaluation)

a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).
b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
c. Write a program that finds if a given number is a prime number

Task 5: (Expression Evaluation)

a. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
b. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
c. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Task 6: (Expression Evaluation)

a. Write a C program to find the roots of a Quadratic equation.
b. Write a C program to calculate the following, where x is a fractional value.

   1-x/2 +x^2/4-x^3/6

c. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3+…….+x^n. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Task 7: (Arrays and Pointers and Functions)

a. Write a C program to find the minimum, maximum and average in an array of integers.
b. Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.
c. Write a C program that uses functions to perform the following:
   i. Addition of Two Matrices
   ii. Multiplication of Two Matrices
   iii. Transpose of a matrix

   with memory dynamically allocated for the new matrix as row and column counts may not be same.

Task 8: (Arrays and Pointers and Functions)

a. Write C programs that use both recursive and non-recursive functions
    i. To find the factorial of a given integer.
    ii. To find the GCD (greatest common divisor) of two given integers.
    iii. To find x^n
b. Write a program for reading elements using pointer into array and display the values using array.
c. Write a program for display values reverse order from array using pointer.
d. Write a program through pointer variable to sum of n elements from array.

Task 9: (Files)

a. Write a C program to display the contents of a file to standard output device.
b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

Task 10: (Files)

a. Write a C program that does the following: It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function) Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function).The program should then read all 10 values and print them back.
b. Write a C program to merge two files into a third file (i.e., the contents of the firs t file followed by those of the second are put in the third file).

Task 11: (Strings)

a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
c. Write a C program that uses functions to perform the following operations:
    i. To insert a sub-string in to a given main string from a given position.
    ii. To delete n Characters from a given position in a given string.

Task 12: (Strings)

a. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
b. Write a C program that displays the position of a character ch in the string S or – 1 if S doesn‘t contain ch.
c. Write a C program to count the lines, words and characters in a given text.

Task 13: (Miscellaneous)

a. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.
b. Write a C program to construct a pyramid of numbers as follows:

```
 1          *          1          1          *
1 2        * *        2 3        2 2        * *
1 2 3      * * *      4 5 6      3 3 3      * * *
 4 4 4 4    * *
 *
```

Task 14: (Sorting and Searching)

a. Write a C program that uses non recursive function to search for a Key value in a given list of integers using linear search method.
b. Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using binary search method.
c. Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.

Task 15: (Sorting and Searching)

a. Write a C program that sorts the given array of integers using selection sort in descending order.
b. Write a C program that sorts the given array of integers using insertion sort in ascending order.
c. Write a C program that sorts a given array of names.

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Code: GR18A1002 **L/T/P/C: 3/1/0/4**

Course Objectives: To provide the student with

- The knowledge to visualize solutions to engineering problems governed by differential equations.
- The skill of evaluating multiple integrals needed for applications in mechanics and electro-magnetic field theory.
- The knowledge to visualize the functions arising in vector field theory and use mathematical tools for some computations.
- The skill of calculating work done by a field and flux across a surface.
- The skill of using specialized theorems for fast computation of work and flux.

Course Outcomes: After learning the contents of this paper the student must be able to

- Classify the differential equations of first order and solve them analytically by suggested methods.
- Solve linear differential equations of higher order under various forcing functions.
- Evaluate double and triple integrals and apply them to some problems in geometry and mechanics.
- Perform vector differential operations on scalar and vector fields and apply them to solve some field related problems.
- Apply classical vector integral theorems for fast computation of work done around closed curves and flux across closed surfaces.

Unit I: FIRST ORDER ODE

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

Non - linear differential equations of the first order: Equations solvable for *p*, equations solvable for *x*, equations solvable for *y*.

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: Areas (by double integrals) and volumes (by double integrals and triple integrals), Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallelepipeds

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 fields, irrotational fields, potentials.

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 proofs) and their applications

Text/Reference Books:

1. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa publishing house,
2. Fourth edition 2014
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
5. 4.. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
6. GRIET reference manual
7. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
8. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY

Course Code: GR18A1005 **L/T/P/C: 3/1/0/4**

Course Objectives:

The objectives of the course are to provide the students

- To relate how the basic concepts and principles of chemistry can be applied to practical utility in a broader perspective of the society.
- 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.
- To identify and apply various principles of electrochemistry, corrosion and water treatment which are essential for an engineer in industry.
- To acquire knowledge of existence of different organic molecules in different stereochemical orientations useful for understanding reaction path ways.
- To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.

Course Outcomes:

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

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

Unit I: ATOMIC AND MOLECULAR STRUCTURE

Atomic and molecular orbitals, Linear Combination of Atomic Orbitals (LCAO), Molecular orbitals 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

Regions of electromagnetic spectrum, Molecular spectroscopy Rotational Spectroscopy: Rotation of molecules, rotational spectra of rigid diatomic molecules, selection rules.Vibrational Spectroscopy: The vibrating diatomic molecule, simple and anharmonic oscillators of a diatomic molecule, selection rules, applications of IR spectroscopy. Nuclear Magnetic Resonance: Basic concepts of NMR, Chemical shift, Magnetic resonance Imaging.

Unit III: ELECTROCHEMISTRY AND CORROSION

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. Fuel cells: hydrogen-oxygen fuel cell - applications and advantages.

Corrosion: Definition, causes and effects of corrosion, Theories 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

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, melting and boiling points, glass transition temperature, viscoelasticity. Compounding and fabrication by compression moulding and injection moulding, conducting polymers – definition, classification, application.

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

Unit V: STEREOCHEMISTRY AND ENERGY RESOURCES

Stereo chemistry: Structural isomers and stereoisomers, representations of 3D structures, configurations and symmetry, chirality, enantiomers, diastereomers, optical activity, conformational analysis of n-butane. Structure, synthesis and pharmaceutical applications of paracetamol and aspirin.

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 engines, Octane rating and cetane number. Composition and Uses of Natural gas, LPG and CNG.

Text/Reference Books:

1. Engineering Chemistry by P.C. Jain and M. Jain; DhanpatRai Publishing Company (P) Ltd., New Delhi.
2. Engineering Chemistry by PrasantaRath, B. Rama Devi, Ch. VenkataRamanareddy, S.Chakroborty. Cengage publications, 2018.
3. University Chemistry, by B.H. Mahan.
4. Engineering Chemistry by B. Siva Sankar, McGraw Hill Publication.
5. Fundamentals of Molecular Spectroscopy, by C.N. Banwell. McGraw Hill Publication
6. A Text book of Engineering Chemistry by Shashi Chawla, DhanpatRai Publishing Company (P) Ltd., New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING MECHANICS

Course Code: GR18A1009 **L/T/P/C: 3/1/0/4**

Course Objectives:

The objectives of the course are to provide the students to

- Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium.
- Perform analysis of bodies lying on rough surfaces.
- Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections.
- Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
- Explain the concepts of work-energy method, impulse-momentum and its applications to translation, rotation and plane motion.

Course Outcomes:

At the end of the course students will be able to

- Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate moment of inertia of a given section.
- Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, fixed axis rotation and plane motion.
- 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 and Spatial Systems; Static Indeterminacy

Unit II: FRICTION

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. – Theorem of Pappus

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, Moment of

Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies.

Unit IV: 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).

Unit V: KINETICS OF RIGID BODIES

Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

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, Jaan Kiusalaas, "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

ENGLISH

Course Code: GR18A1006 **L/T/P/C: 2/0/0/2**

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students.

In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures.*

Course Objectives: The course will help to

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

Course Outcomes: Students will be able to

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

Unit I

'The Raman Effect' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary Building: The Concept of Word Formation--The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles andPrepositions.

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: Letter Writing
Vocabulary: Synonyms and Antonyms. Use of phrases for formal and informal letter writing. Eg., I would like to apply, I regret to inform, This is to bring to your kind notice... etc.
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronounAgreement and Subject-verb Agreement.
Reading: Improving Comprehension Skills – Techniques for Good Comprehension, Read a letter
Writing: Format of a Formal Letter-
Writing Formal Letters E.g.., Letter of Complaint,Letter of Requisition, Job Application with Resume. Reorganising of sentences /paragraphs in a letter.

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 Modifiersand Tenses.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Nature and Style of Sensible Writing-
Defining- Describing Objects, Places andEvents – **Classifying**- Providing Examples or Evidence

Unit IV
'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading
Writing: Writing Practices--Writing Introduction and Conclusion - Essay Writing-PrécisWriting.

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
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice

Writing: **Technical Reports**- Introduction – Characteristics of a Report – Categories ofReports

Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Text/Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY LAB

Course code: GR18A1013 **L/T/P/C: 0/0/3/1.5**

Course Objectives:

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

Course Outcomes:

- Perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- Determination of parameters like hardness and chloride content in water.
- Understand the kinetics of reactions from a change in concentrations of reactants or products as a function of time.
- Synthesize a drug molecule as an example of organic synthesis methods widely used in industry.
- Determination of physical properties like adsorption and viscosity.

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

TASK 1: Determination total hardness of water by complexometric method using EDTA.

TASK 2: Determination of chloride content of water by Argentometry.

TASK 3: Redox titration: Estimation of ferrous iron using standard $KMnO_4$

TASK 4: Estimation of HCl by Conductometric titrations

TASK 5: Estimation of Acetic acid by Conductometric titrations

TASK 6: Estimation of Ferrous iron by Potentiometry using dichromate

TASK 7: Determination of rate constant of acid catalyzed reaction of methyl acetate

TASK 8: Determination of acid value of coconut oil.

TASK 9: Adsorption of acetic acid by charcoal

TASK 10: Determination of surface tension of liquid by using stalagmometer

TASK 11: Determination of viscosity of liquid by using Ostwald's viscometer.

TASK 12: Determination of partition coefficient of acetic acid between n-butanol and water.

TASK 13: Synthesis of Aspirin

TASK 14: Synthesis of Paracetamol.

Text/Reference Books:

1. Vogel's text book of Practical Organic Chemistry, 5th Edition.
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. An Introduction to Practical Chemistry, K.K. Sharma and D.S. Sharma (Vikas Publications, New Delhi)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course code: GR18A1014 **L/T/P/C: 0/0/2/1**

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
- To sensitize students to the nuances of English speech sounds, word accent, intonation, rhythm and Neutralization of accent for intelligibility
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking and interviews

Course Outcomes:

- Interpret the role and importance of various forms of communication skills.
- Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.
- Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
- Recognise the need to work in teams with appropriate ethical, social and professional responsibilities.
- 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

Listening Skills Objectives:

1. To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation

2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

- Listening for general content
- Listening for specific information

Speaking Skills
Objectives:

- To involve students in speaking activities in various contexts
- To enable students express themselves fluently and appropriately in social and professional contexts
- Oral practice: Just A Minute (JAM) Sessions
- Describing objects/situations/people
- Role play – Individual/Group activities

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Communication at Work Place- Spoken vs. Written language.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – 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:

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: How to make Formal Presentations.

Practice: Formal Presentations.

Exercise – IV:

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks.

Practice: Making a Short Speech – Extempore.

Exercise – V:

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Interview Skills.

Practice: Mock Interviews.

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning** (CALL) Lab

Computer systems, headphones and English language learning software for self- study by students.

- **Interactive Communication Skills (ICS) Lab:**

The Interactive Communication Skills Lab: A Spacious room with movable chairs, audio-visual aids with a Podium, LCD and a projector.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING WORKSHOP

Course Code: GR18A1017 **L/T/P/C: 1/0/1.5/2.5**

Course objectives:

The objectives of the course are to provide the students

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

Course Outcomes:

At the end of the course students will be able to

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

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

i. Carpentry
ii. Fitting Shop
iii. Tin-Smithy
iv. Casting
v. Welding Practice
vi. House-wiring
vii. Black Smithy

2. 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.Sreekanjana

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO ELECTROMAGNETIC THEORY

Course Code: GR18A2036 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course objectives

- Describe the calculation of electric fields for a given charge distributions and interpret electrostatic potential in Laplace and poissons equation.
- Calculate capacitance and polarization in dielectric materials.
- Identify, formulate Biot-savart's law, classification of magnetic materials.
- Discuss Maxwell's equation to describe how electric and magnetic fields are generated by charges, currents and changes of fields.
- Indentify the characteristics of electromagnetic waves in different media.

Course outcomes

- Apply vector calculus to understand the behavior of static electric fields.
- Describe and analyze electric field and electrostatic potential in boundary conditions.
- Determine and describe the charge distributions, the dipole, dielectric and conducting spheres immersed in electric fields.
- Explain vector calculus to understand the behavior of static magnetic fields.
- Interpret Maxwell's equation in different forms (Differtial and integral) and apply them to diverse engineering problems.
- Apply Maxwell's equation for electromagnetic wave propagation.
- Interpret the concept of guiding of electromagnetic waves by constructive multiple reflections from conductors and dielectrics.

Pre-requisites (if any) Mathematics course with vector calculus

Unit I

Electrostatics in vacuum (8 lectures) Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Farady's cage and coffee-ring effect; Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

Unit II

Electrostatics in a linear dielectric medium (4 lectures) Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Unit III

Magneto statics(9 lectures) Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Magneto statics in a linear magnetic medium: - Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on and . Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Unit IV

Faraday's law (9 lectures) Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field**. Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations** :- Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time dependent electric field; calculating magnetic field due to changing electric fields in quasistatic approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.

Unit V

Electromagnetic waves (8 lectures) The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Teaching Methodologies

1. Power Point Presentations
2. Assignments uploaded in website.
3. Moodle Courses

Text Books/ Reference Books

1. David Griffiths, Introduction to Electrodynamics
2. Sadiku,mathew N.O-Element of electrodynamics
3. *William* H. *Hayt*, Jr. . John A. Buck. –Engineering Electromagnetics
4. Halliday and Resnick, Physic
5. W. Saslow, Electricity, magnetism and light

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATERIALS ENGINEERING

Course Code: GR18A2037 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Objectives:

The objectives of this course are to provide the students

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

Course Outcomes:

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

- Relate crystal structures and identify the relation between different materials.
- Test the various mechanical properties of metal by suitable method.
- Relate the equilibrium transformation diagrams for various metals.
- Utilize appropriate techniques in treating a metal with proper heat treatment operations.
- Have knowledge on different types of ferrous and nonferrous metals.

Unit I: CRYSTALSTRUCTURE

Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.

Unit II: DUCTILE AND BRITTLE FAILURE MECHANISMS

Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to non- destructive testing (NDT)

Unit III: ALLOYS, SUBSTITUTIONAL AND INTERSTITIAL SOLID SOLUTIONS-PHASE DIAGRAMS

Interpretation of binary phase diagrams and microstructure development, eutectic,

peritectic, peritectoid and mono tactic reactions. IronIron-carbide phase diagram and micro structural aspects of ledeburite, austenite, ferrite and cementite, castiron.

Unit IV: HEATTREATMENTOFSTEEL

Annealing, tempering, normalizing and spheroidising, isothermal transformation diagrams for Fe-C alloys and micro structure development. Continuous cooling curves and interpretation of final microstructures and properties-austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

Unit V: ALLOYINGOFSTEEL

Properties of stainless steel and tool steels, maraging steels, cast irons; grey, white, malleable and spheroidal cast irons, copper and copper alloys; brass, bronze and cupro-nickel; aluminium and Al-Cu–Mg alloys-Nickel based super alloys and Titanium alloys .

Text/ReferenceBooks:

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 of India Private Limited, 4th Indian Reprint, 2002.
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

Course Code: GR18A2038 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Objectives:

At the end of the course the student is expected to

- Prepare the students a basic knowledge in the analysis of Electric Circuits.
- 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.
- Train the students to have the solid foundation in technical concepts required to engineering problems.
- Train the students in understanding the usage of electronic instruments in measuring techniques.
- Have a thorough understanding on transistors and its uses

Course Outcomes:

At the end of the course students will be able to

- Interpret and familiar with ac and dc circuits solving.
- An ability to find role of electrical machinery in simple & complex applications.
- 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.
- Analyze performance of Transformers and Instruments.
- 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 – torque equation – applications – three point starter.

Principle of operation of alternators – regulation by synchronous impedance method – Principle of 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

Course Code: GR18A2039 **L/T/P/C: 3/0/0/3**

II Year I Semester

Prerequisites: Knowledge in Engineering Mechanics (statics)

Course Objectives:

The objectives of this course are to provide the students:

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

Course Outcomes:

At the end of the course, the student shall be able to

- Understand the theory of elasticity including strain displacement and Hooke's law relationships.
- Analyse the shear stresses and bending moment diagrams with various types of loads.
- Calculate the slope and deflections in beams subjected to transverse loads.
- Analyse various situations involving structural members subjected to combined stresses and solve the torsion problems in bars.
- 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 & 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: GR18A2040 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Objectives:

The objectives of this course are to provide the students to

- Understand the nature and role of the following thermodynamic properties of matter: internal energy, enthalpy, entropy, temperature, pressure and specific volume.
- Be able to represent 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.
- Recognize and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another.
- Understand implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems.
- Be able to quantify the performance of Diesel engine, Petrol engine, Gas turbine, refrigeration and heat pump systems.

Course Outcomes:

At the end of the course students will be able to

- Understand the first and second laws of thermodynamics and their application to a wide range of systems.
- Understand the first law of thermodynamics and various forms of work that can occur.
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
- Understand the calculations of the efficiencies of heat engines and other engineering devices.
- Understand 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, Work-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

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, Saturation tables, Superheated tables, Identification of states & determination of properties, Mollier's chart.

Unit III

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 IV

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, Lost work. Second law analysis for a control volume, Exergy balance equation and Exergy analysis.

Unit V: **THERMODYNAMICCYCLES**

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

Text/Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MACHINE AND PRODUCTION DRAWING

Course Code: GR18A2041 **L/T/P/C: 0/0/6/3**

II Year I Semester

Course Objectives:

The objectives of this course are to provide the students

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

Course Outcomes:

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

- Understand the conventions used in Machine & production drawing.
- Construct the machine elements including couplings, cotters, riveted, and bolted joints.
- Determine limits and fits and allocate tolerances for machine components.
- Construct an assembly drawing using part drawings of machine components.
- 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: GR18A2042 **L/T/P/C:0/0/3/1.5**

II Year I Semester

Prerequisites: Fundamentals of Engineering Mechanics, Mechanics of materials.

Course Objectives:

The objectives of this course are to provide the students

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

Course Outcomes:

Upon completion of this course, the students will be able to

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

Following experiments need to be conducted;

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 modulus and

b) Shear test to determine ultimate shear strength

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 the material

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 Beam set-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 rig

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY

MATERIAL SCIENCE AND METALLURGY LAB

Course Code: GR18A2043 **L/T/P/C:0/0/3/1.5**

II Year I Semester

Course Objectives:

The objectives of this course are to provide the students

- To know the micro structure of different materials.
- To know the properties of materials at higher elevated temperatures.
- Refine grain size by various heat treatment processes.
- To gain knowledge on various materials for product based on microstructure.
- To know differences between ferrous and nonferrous metals with their properties.

Course Outcomes:

Upon completion of this course, the students will be able to

- Relate properties to microstructure.
- Choose suitable metals and alloys for industrial applications.
- Find out the hardness of various treated and untreated metals.
- Tell the chemical composition of various ferrous and nonferrous metals.
- 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 cast iron.
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

ENVIRONMENTAL SCIENCE

Course Code: GR18A2001 **L/T/P/C: 2/0/0/2**

II Year II Semester

Course Objectives:

The objectives of the course are

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations.
- Integrate human ecology and science of environmental problems.
- The effect of human activities on atmospheric pollution

Course Outcomes:

Based on this course, the Engineering graduate will

- Understand the harmonious co-existence in between nature and human being.
- Recognize various problems related to environment degradation.
- Develop relevant research questions for environmental investigation.
- Generate ideas and solutions to solve environmental problems due to soil, air and water pollution.
- 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 value, services and carrying capacity, Field visits.

Unit II: NATURAL RESOURCES

Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground 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

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 water Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. 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. NAPCC-GoI Initiatives.

Unit V: ENVIRONMENTAL POLICY, LEGISLATION & EIA

Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economic aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

Text/Reference Books:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Raja gopalan, Oxford University Press.
3. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
4. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela.2008 PHI Learning Pvt. Ltd.
5. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
6. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
7. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
8. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIEDTHERMODYNAMICS

Course Code: GR18A2044 **L/T/P/C: 3/1/0/4**

II Year II Semester

Course Objectives:

The objectives of this course are to provide the students

- To understand about I law for reacting systems and heating value of fuels.
- To learn about gas and vapor cycles and their first law and second law efficiencies.
- To understand about the properties of dry and wet air and the principles of psychrometry.
- To study about gas dynamics of air flow and steam through nozzles.
- To analyze about reciprocating compressors with and without inter cooling and analyze the performance of steam turbines.

Course Outcomes:

At the end of the course, the student shall be able to

- Understand and explain the various practical power cycles and heat pump cycles.
- Analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.
- Understand phenomena occurring in high speed compressible flows, necessity of staging of reciprocating compressors and performance improvement methods.
- To focus on the working principles of components of gas turbine power plant and can illustrate the methods to enhance the performance of the plant.
- Elaborate the principles of Psychrometry using properties of dry and wet air.

Unit I

Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis-First law analysis of combustion reactions-Heat calculations using enthalpy tables-Adiabatic flame temperature-Chemical equilibrium and equilibrium composition calculations using free energy.

Unit II

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle-Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and inter cooling-Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

Unit III

Properties of dry and wet air, use of psychrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

Unit IV

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows-normal shocks-use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation-compressible flow in diffusers, efficiency of nozzle and diffuser.

Unit V

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of inter cooling, minimum work for multi stage reciprocating compressors. Analysis of steam turbines, velocity and pressure compounding of steam turbines.

Text/ReferenceBooks:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLUID MECHANICS AND FLUID MACHINES

Course Code: GR18A2045 **L/T/P/C: 3/0/0/3**

II Year II Semester

Course Objectives:

The objectives of this course are to provide the students

- To learn about the application of mass and momentum conservation laws for fluid flows.
- To understand the importance of dimensional analysis.
- To obtain the velocity and pressure variations in various types of simple flows.
- To analyze the flow in water pumps and turbines.
- To learn about the application of Energy conservation laws for fluid flows.

Course Outcomes:

Upon completion of this course, the students will be able to

- Apply concept of mathematics, science and engineering.
- Use the governing equations of fluid flow and applying them to simple flow problems.
- Explain the mathematical formulation of various flow problems.
- Analyze the boundary layer concept to the fluid flow problems.
- Apply 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 Poisuielle 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. Fluid Mechanics and Hydraulic Machines by R K Rajput.
3. Fluid Mechanics and Hydraulic machines by R K Bansal, Laxmi publications.
4. Fluid Mechanics & Hydraulic Machines: Problems & Solutions by K.Subrmanya /TMH private limited.
5. Hydraulic Machines by Banga& Sharma, Khanna Publishers.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

KINEMATICS OF MACHINERY

Course Code: GR18A2046 **L/T/P/C: 3/1/0/4**

II Year II Semester

Course Objectives:

The objectives of this course are to provide the students

- To understand the kinematics and rigid-body dynamics of kinematically driven machine components.
- To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
- To be able to design some linkage mechanisms and cam systems to generate specified output motion.
- To understand the kinematics of gear trains.
- To estimate of transmission of power by belts drives.

Course Outcomes:

After completion of each course student should be able to

- Identify, select and design various types of linkage mechanisms for obtaining specific motion with lower pairs and higher pairs.
- Analyse analytical and graphical aspects of linkage mechanisms for optimal functioning.
- Drawing displacement diagrams and cam profile diagram for followers executing different types of motions for various configurations of followers.
- Evaluate gear tooth geometry and select appropriate gears for the required applications.
- 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, 3rd 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-West Pvt. Ltd, New Delhi, 1988.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHN

PROBABILITY AND STATISTICS

Course Code : GR18A2005 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course objectives:

On completion of this Course, the student shall be able to

- State the fundamentals of Probability and Statistics.
- Describe the properties of random variables and distributions.
- Interpret the measures of central tendency, dispersion, and association.
- Distinguish between explanatory and response variables and analyze multi variable data using correlation and regression.
- Apply the tests of hypothesis.

Course Outcomes:

The expected outcomes of the Course are to

- Estimate the chance of occurrence of various uncertain events in different random experiments with strong basics of probability.
- Compute and interpret descriptive statistics.
- Evaluate random processes which occur in engineering applications governed by the Binomial, Poisson, Multinomial, Exponential, Normal and Gamma distributions.
- Forecast the models using Regression Analysis.
- Apply Inferential Statistics to make predictions or judgments about the population from which the sample data is drawn.

Module 1: **BASIC PROBABILITY AND RANDOM VARIABLES** (10 hours)

Probability spaces, conditional probability, independence, Bayes' rule; Discrete random variables, Continuous random variables and their properties, Distribution functions and densities

Independent random variables, Sums of independent random variables; Expectation of Discrete and Continuos Random Variables, Moments, Variance of a sum, Chebyshev's Inequality.

Module 2: BASIC STATISTICS AND DISCRETE PROBABILITY DISTRIBUTIONS (10 hours)

Measures of Central tendency: Moments, Skewness and Kurtosis.

Probability distributions: Infinite sequences of Bernoulli trials, Binomial, Poisson, Poisson approximation to the binomial distribution, multinomial distribution and evaluation of statistical parameters for Binomial and Poisson distributions.

Module 3: **CONTINUOUS PROBABILITY DISTRIBUTIONS AND BIVARIATE DISTRIBUTIONS** (8 hours)

Bivariate distributions and their properties, Distribution of sums and quotients, Conditional densities. Normal, Exponential and Gamma density functions, Evaluation of statistical parameters for Normal distribution.

Module 4: CURVE FITTING, CORRELATION AND REGRESSION(6 hours)
Curve fitting by the method of least squares- fitting of straight line, Second degree parabola, Exponential and Power curves. Correlation (Karl Pearson's Correlation coefficient and Spearman's Rank correlation (Statements of their properties and problems)), Regression (including Multiple regression with two independent random variables), (Statements of their properties and problems only).

Module 5: APPLIED STATISTICS (6 hours)
Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Test for single mean, difference of means and correlation coefficient, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text / Reference Books:

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
3. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
4. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.
5. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
6. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
7. T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MANUFACTURING PROCESSES

Course Code: GR18A2047 **L/T/P/C: 3/0/0/3**

II Year II Semester

Course Objectives:

The objectives of this course are to provide the students

- Inculcate the knowledge of various casting and forming methods in manufacturing.
- Impart knowledge about tool geometry, cutting forces, chip formation and various machine tools used in metal cutting processes.
- Inculcate the knowledge in joining processes and advancements in manufacturing.
- Impart knowledge about unconventional processes.
- Inculcate the knowledge on surface finish and economics in machining process.

Course Outcomes:

At the end of the course, the student shall be able to

- Apply primary and secondary manufacturing methods in producing the component.
- Design the tool based on the process parameters, cutting forces, and chip formation.
- Execute the joining methods and additive manufacturing methods in real time application.
- Execute the unconventional machining process.
- Perform economics of machining, surface finish and tool life estimation.

Unit I

Conventional Manufacturing processes: Casting and moulding, Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Unit II

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Unit III

Additive manufacturing: Rapid prototyping and rapid tooling

Joining/fastening processes: Physics of welding, brazing ands oldering, design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Unit IV

Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, laser beam Machining (LBM), Plasma Arc Machining (PAM) and Electron BeamMachining.

Unit V

Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish.

Text/Reference Books:

1. Kalpakji anand Schmid, Manufacturing processes for engineering materials (5thEdition)-Pearson India, 2014.
2. Mikell P.Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems
3. Degarmo, Black & Kohser, Materials and Processes in manufacturing

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THERMAL ENGINEERING LAB

Course Code: GR18A2048 **L/T/P/C: 0/0/3/1.5**

II Year II Semester

Course Objectives:

The objectives of the course are to provide the students

- Understand the working principles of the each component of internal combustion engines, refrigeration system, Boilers etc.
- Explore to measuring devices functioning for air, fuel, temperature, pressure, loading, speed etc.
- Recollect the basic conservation of energy principles, laws of thermodynamics for real time applications.
- Explain the process involved in the thermal systems for assessing the performance and its enhancement using graphs, balance sheets etc.
- Summarize the differences between internal and external combustion engines, reciprocating and rotary type with merits and limitations.

Course Outcomes:

At the end of the course student will be able to

- 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.
- Evaluate the properties of fuels such as flash & fire points, calorific values using basic concepts by conducting experimentation.
- Assess the performance parameters of different thermal systems such as diesel/Petrol engines, refrigeration system, air compressors, Boilers etc.,
- Enumerate and calculate the amount of dissipation of heat/energy in different ways by drawing balance sheets for an IC Engine.
- 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: Disassembly/Assembly 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: Determination of the p-V diagram and the performance of a 4-stroke 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 single cylinder 4 stroke diesel engine with eddy Mechanical loading

Task-6: Heat balance test on single cylinder 4 stroke diesel engine with eddy 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 PROCESSES LAB

Course Code: GR18A2049 **L/T/P/C:0/0/3/1.5**

II Year II Semester

Prerequisites: Fundamentals of Production of Technology

Course Objectives:

The objectives of this course are to provide the students

- To provide practical experience in various welding processes with different materials.
- To give knowledge and practical exposure on how to form plastic formation by using plastic moulding machine.
- To impart Knowledge in casting process with various types of tools.
- To know various welding processes.
- To impart knowledge on various production processes in manufacturing a product.

Course Outcomes:

- To design and manufacture simple patterns for castings.
- Knowledge on different kinds of joining processes.
- To manufacture plastic components.
- Knowledge on different kinds of production processes available for shaping or moulding several daily used components.
- To 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. TIG Welding-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 press tool.
2. Hydraulic Press: Deep drawing.
3. Bending and other operations

Task-4: PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLUID MECHANICS AND FLUID MACHINES LAB

Course Code: GR18A2050 **L/T/P/C: 0/0/1/1**

II Year II Semester

Prerequisites: Fundamentals of Fluid Mechanics and Hydraulic Machinery

Course Objectives:

The objectives of the course are to provide the students

- To provide practical knowledge in verification of principles of fluid flow.
- To impart knowledge in measuring pressure, discharge and velocity of fluid flow.
- To understand Major and Minor Losses.
- To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.
- To familiarize laminar and turbulent flows in pipes.

Course Outcomes:

At the end of the course student should be able to

- Demonstrate practical knowledge in fluid flow principles.
- Demonstrate the knowledge in calculating performance analysis in turbines and pumps understand to analyse practical problems in all power plants and chemical industries.
- Conduct experiments in pipe flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Analyse a variety of fluid-flow devices and utilize fluid mechanics principles in design.
- 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 Orifice meter.

Task-3: Determination of Darcy's Friction factor in various diameters of pipes

Task-4: Determination of Minor Losses (Different Valve connections, Sudden Expansion, 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 Constant Speed and Constant Head

Task-7: Determination of overall efficiency of Francis Turbine at Constant Speed and Constant Head

Task-8: Determination of overall efficiency of Kaplan Turbine at Constant Speed and 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: GR18A2003 **L/T/P/C: 2/0/0/2**

Course Objectives:

- To create an awareness about the Constitution of India, Fundamental Rights and Duties, Directive Principles.
- To Learn the role of Prime Minister, President and the Council of Ministers and the State Legislature.
- To learn the divisions of executive, legislative and judiciary and so on.
- To know how a municipal office, panchayat office etc. works.
- To understand the importance and role of Election Commission Functions.

Course Outcomes:

- Students will be able to know the importance of Constitution and Government.
- Students will be able to become Good Citizens and know their fundamental rights, duties and principles.
- Students will learn about the role of PM, President, Council of Ministers and Local Administration.
- The Students understand the importance of Election Commission.
- They will know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of 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 Elected and 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