ACADEMIC REGULATIONS & CURRICULUM

Applicable to the students admitted from the Academic Year 2020-2021

CHEMICAL ENGINEERING

(B.Tech. Programme)

MAHARAJ VIJAYARAM GAJAPATHI RAJ COLLEGE OF ENGINEERING
(Autonomous)

(Approved by AICTE, New Delhi, and permanently affiliated to JNTUK, Kakinada)

Listed u/s 2(f) & 12(B) of UGC Act 1956.

Vijayaram Nagar Campus, Chintalavalasa,Vizianagaram-535005, Andhra Pradesh

The visionaries

Late Dr. P V G Raju
Raja Saheb of Vizianagaram
Founder Chairman-MANSAS
Ex-Minister for Education and Health, Govt. of AP
Ex Member of Parliament

Late Dr. P. Anand Gajapathi Raju
Ex-Chairman-MANSAS
Ex-Minister for Education and Health
Govt. of AP
Ex Member of Parliament

P. Ashok Gajapathi Raju
Chairman-MANSAS
Ex-Union Minister for Civil Aviation,
Govt. of India
Ex-Minister for Finance, Govt. of AP

Vision

Maharaj Vijayaram Gajapathi Raj College of Engineering strives to become a centre par excellence for technical education where aspiring students can be transformed into skilled and well-rounded professionals with strong understanding of fundamentals, a flair for responsible innovation in engineering practical solutions applying the fundamentals, and confidence and poise to meet the challenges in their chosen professional spheres.

Mission

The management believes imparting quality education in an atmosphere that motivates learning as a social obligation which we owe to the students, their parents/guardians and society at large and hence the effort is to leave no stone unturned in providing the same with all sincerity. Towards that end, the management believes special focus has to be on the following areas:

M1: Have on-board staff with high quality experience and continuously updating themselves with latest research developments and sharing that knowledge with students.

M2: Having a well stream-lined teaching learning process that is continuously assessed for effectiveness and fine-tuned for improvement.

M3: Having state-of-the-art lab and general infrastructure that gives students the necessary tools and means to enhance their knowledge and understanding.

M4: Having a centralized department focused on improving placement opportunities for our students directly on campus and coordinating the training programs for students to complement the curriculum and enhance their career opportunities.

M5: Having advanced research facilities and more importantly atmosphere to encourage students to pursue self-learning on advanced topics and conduct research.

ABOUT THE INSTITUTION:

Maharajah Alak Narayan Society of Arts and Science (MANSAS) is an Educational Trust founded by Dr. (late) P.V.G Raju, Raja Saheb of Vizianagaram in the hallowed memory of his father Maharajah Alak Narayan Gajapati with a view to confound socio-economic inequalities in the Vizianagaram principality executing a trust deed on 12-11-1958 duly established Maharajah's College and other educational institutions in and around Vizianagaram. The Trust is a charitable one published under Section 6 a (1) of A.P Charitable and Hindu Religious Institutions and Endowment Act 30 of 1987.

The object of the Trust is to manage the properties of educational institutions under it and to promote and advance the cause of education in general, besides awarding scholarships to deserving students enabling them to undergo special training in science and industries in and out of India. The Trust has made an uncompromising contribution to the nation by presenting the stalwarts.

Trust offers KG to PhD level education in Arts, Sciences, Law, Pharmacy, Humanities Education, Engineering and Management and presently houses 13 Educational Institutions. MVGR College of Engineering is one of the 13 Institutes.

Other Institutions under MANSAS

1. M.R. HIGH SCHOOL 1857
2. M.R COLLEGE **(NAAC ACCREDITED)** 1879
3. M.R. COLLEGE OF EDUCATION 1950
4. M.R. WOMENS COLLEGE **(NAAC ACCREDITED)** 1962
5. M.R. GIRLS HIGH SCHOOL 1974
6. M.R. MODEL HIGH SCHOOL 1974
7. M.R. ENGLISH MEDIUM SCHOOL 1979
8. M.R.V.R.G.R LAW COLLEGE 1987
9. M.R. P.G. COLLEGE **(NAAC ACCREDITED)** 1987
10. M.R.SCHOOL OF MANAGEMENT STUDIES 1994
11. M.R.V.R.G.R – II MEMORIAL JR. COLLEGE 1994
12. M.R. COLLEGE OF PHARMACY 2004

Maharaj Vijayaram Gajapathi Raj (MVGR) College of Engineering was established in the year 1997 by Maharaj Alak Narayan Society for Arts and Sciences (MANSAS) to impart quality technical education. The Institution is located in lush green, serene and pollution free environment spread over 60 acres of land in Chintalavalasa village situated in the outskirts of Vizianagaram, a fort city in the north coastal region of Andhra Pradesh.

Institution at a glance:

- MVGR is a 23 years old institution, established in 1997
- All eligible UG Programs (CHEMICAL, CIV, CSE, ECE, EEE, IT & MECHANICAL) were reaccredited by NBA.
- MBA program was also re-accredited by NBA.
- Had been re-accredited with Grade 'A' by NAAC of UGC
- Has Permanent affiliation with JN Technological University-Kakinada
- Listed under sections 2(f) & 12(b) of UGC act 1956.
- Approved by AICTE-New Delhi
- EIGHT departments are recognized as RESEARCH CENTERS by JNTU-K
- Granted Autonomy by UGC in 2015
- Campus of 60 acre
- Offering 7 UG and 5 M.Tech., and 1 MBA program
- About 250 faculty of which 84 Ph.D. Degree holders
- 83 Laboratories with an investment of about 13 Crores
- Total built up area of about 7 Lakh Sft
- About 42,000 volumes and Access to 8 international online journal packages like IEEE, SPRINGER, etc.
- 1420 Systems & 395 Mbps band width internet facility
- About Rs. 4 Crore worth of on-going R&D projects
- Actively involved in civil engineering consultancy work as Third Party Quality Auditor for Vizianagaram Municipality
- WIPRO Recognized technology learning center and MISSION 10X partner institution
- Recognized National Instruments Academy for Training in LabView
- SIRO Recognition by DSIR
- Recognized PTC Centre of Excellence for Creo Training
- Identified by MSME as Business Incubation Centre
- APSSDC-Siemens Technical Skill Development Institute
- Recognized CMs SKILL EXCELLENCY CENTER (SEC)
- Microsoft Ed-vantage Platinum Partner
- Institutional member of IUCEE
- Institutional Member of CII
- Member, Chamber of Commerce, Vizianagaram
- Green Campus award by Govt. of AP

MVGR College of Engineering is rated as one among the best engineering colleges in the state of Andhra Pradesh as it set up highest standards in all areas of curricular, co-curricular and extra-curricular activities and in students' placements. Based on industry and expert's feedback, the college is updating the curriculum from time to time. The college offers many value added add-on courses students and conducts training programs to meet the industries' requirements.

Academic Regulations for B.Tech., Program

Applicable to the students admitted from the Academic year 2020-2021 onwards.

1. PROGRAM STRUCTURE:

B.Tech.:

Sl. No	Category	Credits
1	Humanities and Social Sciences including Management courses	12
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	26
4	Professional core courses	54
5	Professional Elective courses relevant to chosen specialization/branch	18
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	13
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	0
	Total	160

- Open electives offered by the parent department are listed in the course structure and are offered to students of other programs. The students of parent departments may also opt the course, provided it shall not be listed in the curriculum.
- For audit course a student is deemed to satisfy the minimum contact hours, as prescribed by the department and shall also comply with the requirements for submission of assignments/projects. A student shall also opt for MOOCs and submit the certificate.

1. HSS Courses		
Sl. No.	Subject	Credits
1	English -1	3
2	English -2 (Technical English)	3
3	Elective-1 (Management Related course (MEFA or MS or Operations Research)	3
4	Elective-2 (Professional Ethics and Human Values)	3
	Total	**12**

2. Basic Science Courses		
Sl. No.	Subject	Credits
1	Mathematics-I	3
2	Mathematics-II	3
3	Mathematics-III	3
4	Mathematics-IV	3
5	Applied / Engineering Physics	3
6	Applied / Engineering Physics Lab	2
7	Engineering Chemistry	3
8	Engineering Chemistry Lab	2
9	Biology for Engineers	3
	Total	**25**

3. Engineering Science Courses		
Sl. No.	Subject	Credits
1	Programming for Problem Solving	3
2	Programming for Problem Solving Lab	2
3	Internet of Things (IOT)	3
4	Computer aided Engineering Graphics	3
5	Basic Electrical Engineering	3
6	Basic Electrical Engineering Lab	2
7	Department wise Engineering Science Course-I AI Tools , Techniques & Applications	3
8	AI Tools , Techniques & Applications Lab	2
9	Department wise Engineering Science Course-II (Design thinking and Product Innovation)	3
10	Workshop (Department Specific)	2
	Total	**26**

	Subjects	Credits
1	Professional Core Courses	54
2	Professional Elective Courses Relevant to Chosen Specialization/Branch	18

3	Open Subjects – Electives from other Technical and / or Emerging Subjects	12
		84

7. Project		
Sl. No.	Subject	Credits
1	Socially Relevant Project	1
2	Mini Project	2
3	Project Phase - I	2
4	Project Phase - II	8
	Total	**13**

8. Audit Courses (Non Credit Course)		
Sl. No.	Subject	
1	Induction Program	
2	Constitution of India	
3	Essence of Indian Traditional Knowledge	
4	Environmental Science	

BOS Chairman shall notify the list of MOOCs offered (Open Elective & Professional Elective) in the beginning of the semester.

2. PROGRAM PATTERN:

B.Tech.: The program is for 4 academic years / 8 semesters.

B.Tech. (Lateral Entry): The program is for 3 academic years / 6 semesters.

3. AWARD OF DEGREE:

B.TECH:

A student will be declared eligible for the award of degree if he/she fulfills the following academic regulations.

a) A student shall be declared eligible for the award of degree, if he/she pursues a course of study for not less than four academic years and not more than eight academic years from the date of admission.

b) The student shall register for **160** credits and secure all **160** credits.

c) The medium of instruction for the entire under graduate program in Engineering & Technology will be in **English** only.

d) Skill oriented courses are embedded with domain specific, communication and Advanced / elective courses.

e) A student shall also register and successfully complete audit programs (Non-credit) as recommended by Academic Council.

f) A student on completing 1st year class work may opt for a break of 1 year which shall

be deemed as GAP year, as recommended by APSCHE, for undertaking successful entrepreneurial ventures.

g) Students who fail to complete Four Years Course of study within 8 years shall forfeit their seat and their admission shall stand cancelled.

B.TECH. (Honors)/(Minors) :

B.Tech. with Honors or B.Tech. with Minor will be awarded if the student earns 20 additional credits as per the regulations/guidelines.

B.TECH (Lateral Entry):

A student will be declared eligible for the award of degree on fulfilling the following academic requirements.

a) A student shall be declared eligible for the award of the degree, if he/she pursues a course of study for not less than three academic years and not more than six academic years.

b) The student shall register for **126** credits and secure all **126** credits.

c) A student shall also register and successfully complete audit programs (Non-credit) as recommended by Academic Council.

d) Students who fail to complete their three Years Course of study within 6 years shall forfeit their seat and their admission shall stand cancelled.

e) Student shall register for bridge programs, if any, as administered by the respective departments at the beginning of 2nd year and successfully complete as per the guidelines of the Institution.

B.TECH. (Honors)/(Minors) :

B.Tech. with Honors or B.Tech. with Minor will be awarded if the student earns 20 additional credits as per the regulations/guidelines.

4. CERTIFICATION PROGRAMS:

Sl. No.	Dept.	Name of the Program
1	MECH	Windchill 10.2 PDM by Adroitec Engineering Solutions Pvt. Ltd., Hyderabad
2	MECH	Creo 2.0 by PTC
3	MECH	Edgecam by Verosoft, UK
4	MECH	ANSYS Training and Certification by Mechanical Department
5	MECH	AUTOCAD Training and Certification by Mechanical Department
6	MECH	Catia by APSSDC-Dassault Systems, CM's Center of Excellence
7	MECH	Delmia by APSSDC-Dassault Systems, CM's Center of Excellence
8	MECH	Simulia by APSSDC-Dassault Systems, CM's Center of Excellence
9	MECH	2-Wheeler Automobile Certification by APSSDC-SIEMENS
10	MECH	4-Wheeler Automobile Certification by APSSDC-SIEMENS

11	MECH	Welding Certification by APSSDC-SIEMENS
12	MECH	CNC Certification by APSSDC-SIEMENS
13	MECH	Commercial Electrical Certification by APSSDC-SIEMENS
14	MECH	Solid Edge Certification by APSSDC-SIEMENS
15	CHEM	Chemical Process Design and Simulation by Simtech Simulations, Hyderabad
16	ECE	Embedded Systems by Think LABS, Mumbai
17	ECE	Labview by National Instruments Systems India Pvt. Ltd.
18	ECE	Unified Technology Learning Program (UTLP) by Wipro Mission 10X
19	CSE, IT	PEGA by Virtusa Corporation
20	CSE, IT	Microsoft technologies by Microsoft Corp.
21	CSE, IT	Ethical Hacking by EC-Council Academia
22	CSE, IT	Java and C by Talent Sprint
23	CSE, IT	Network Analyst (CCNA) by Cisco Systems Inc
24	CSE, IT	Java Programming (OCJP) and DBMS by Oracle
25	EEE	PLC, Drives and Automation by Siemens
26	EEE	PLC by New Dawn Automation
27	EEE	Home Electrical Certification by APSSDC-SIEMENS
28	Civil	Remote Sensing and GIS by Indian Institute of Remote Sensing

a) The Institution shall offer the certification programs by itself or in collaboration with industry/such other Institutions deemed to have specialized expertise in the proposed area of training.
b) Only students of the Institution shall be eligible to register on payment of prescribed fee.
c) However, subject to availability of resources and the demand the Institution may offer the program to external candidates meeting the pre-qualification requirements and in the order of the merit.
d) The duration of the course and design of the content shall be done by the respective departments of the Institution by themselves or in collaboration with industry/such other institutions deemed to have specialized expertise in the proposed area of training.
e) If the duration of the course is less than or equal to 40 hours, it can be completed in one semester, otherwise, it can suitably distributed over a number of semesters.
f) Mere enrolment/registration for the program shall not entitle any claim for award of certificate.
g) A candidate shall be deemed eligible for the award of the certificate if he/she
    - Attends at least 75% of scheduled training sessions
    - Complies to all the requirements of submission of the assignments, presentations, seminars, projects, etc., and also appears for periodic tests.
    - Shall attain minimum levels of performance in tests as prescribed.
    - Shall remit such fee as deemed fit for the certification
    - A candidate registered and failed to meet the requirements shall be permitted to repeat the said training one another time after remitting 25% of the fee fixed for the program as re-registration fee.

If the student is absent for the periodic tests, the test shall be re-conducted on payment of

10% of fee.

5. COURSES OFFERED:

Name of the Program	Degree
UG Programs (Engineering & Technology)	B.Tech. (Civil) B.Tech. (EEE) B.Tech. (Mech.) B.Tech. (ECE) B.Tech. (CSE) B.Tech. (CHEM) B.Tech. (IT)
PG Programs (Engineering & Technology)	M.Tech. (Structural Engineering) M.Tech. (Power Systems) M.Tech. (PDM) M.Tech. (VLSI) M.Tech. (CN&IS)
Other PG Programs	MBA
Research Programs	Ph.D. in Civil, EEE, MECH, ECE, CSE, CHEM, MBA and MATHS

6. DISTRIBUTION AND WEIGHTAGE OF MARKS:

B.Tech.:

a). **Theory :**

All Theory courses will have 5 units and assessed for 100 marks, of which, 30 marks for internal assessment and 70 marks for semester end external examination.

Internal Assessment:

Subjective tests - 15 Marks
Objective tests - 10 Marks
Assignments - 05 Marks

- Two Mid – Term examinations (Cycle 1 and Cycle2) shall be conducted. One on first 50% of the syllabus and second on remaining 50% of the syllabus.
- Each Mid Term examination consists of a) Subjective test b) Objective test c) Assignment
- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 5 marks (No choice) and assessed for 15 marks
- Each objective test shall be conducted for 20 minutes and have 20 Multiple

Choice Questions each for 1/2 mark and assessed for 10 Marks.

- Assignments shall be assessed for 5 marks.
- The total marks assessed for each Mid – Term examination (Cycle 1 or Cycle 2) is 30 marks.
- Final internal marks can be calculated with 80% weightage for the better of the two Mid-Term examinations and 20% weightage for other Mid-Term examination.

Example:

Mid-Term 1 (Cycle 1) Marks = Marks secured in (Subjective test-1 + Objective test-1 + Assignment-1)

Mid-Term 2 (Cycle 2) Marks = Marks secured in (Subjective test-2 + Objective test-2 + Assignment-2)

Final internal marks = [Best of (Mid term-1/Mid - Term-2) marks X 0.8 + Least of (Mid Term-1/Mid Term-2) marks X 0.2]

External Assessment:

- External examination is for 70 marks (180 min). Question paper contains 10 questions (2 questions from each unit) and each question carries 14 marks. Student shall answer 5 questions (1 question from each unit).

i) Design Thinking and Product Innovation - Evaluation pattern

Internal Assessment: 30 Marks

Project based learning - 20 Marks

Assignments - 10 Marks

Project based learning: The student has to identify a problem and provide a solution by applying design thinking methodologies and submit a report, which is assessed for 20 Marks.

Assignments: The student has to submit 4 assignments (1 for each unit) and assessed for 10 marks. Each assignment shall consist of 4 questions (4X10 = 40 marks) and the same shall be scaled down to 10 marks. Average of 4 assignments shall be considered as final assignment marks.

External Assessment: 70 Marks

External examination is for 70 marks (180 min). Question paper contains 8 questions from first IV units (2 questions from each unit) and each question carries 12 marks. Student shall answer 4 questions from first IV units (1 question from each unit) and case study (22 Marks) from V unit.

ii) Internet of Things (IoT) , Surveying and Geomatics, MAT Lab Programming, Programming with Lab View, Embedded Processor - Evaluation pattern

Internal Assessment: 30 Marks

Subjective Test - 15 Marks

Project based learning - 15 Marks

- Two subjective tests shall be conducted.
- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 5 marks (No choice) and assessed for 15 marks
- Project based learning shall be assessed for 15 Marks.
- In Project based learning, a student has to identify a problem such that at least 3 or 4 modular learning of experiments shall be integrated and submit comprehensive report with solution at the end of the semester.
- Final internal marks (30 Marks) can be calculated with 80% weightage for the better of the two subjective tests (15 Marks) and 20% weightage for other subjective test plus + Project based learning (15 Marks)

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External Assessment: 70 Marks

External examination is for 70 marks (180 min). Question paper contains 10 questions (2 questions from each unit) and each question carries 14 marks. Student shall answer 5 questions (1 question from each unit).

b). **Laboratory/Practice:**

All Laboratory/Practice courses are assessed for 50 marks, of which, 15 marks for internal assessment and 35 marks for semester end external examination.

Internal Assessment : (15 Marks)

Continuous assessment	: 05 Marks
Project based learning	: 05 Marks
Internal test	: 05 Marks

- Continuous assessment for 05 marks for each experimental session finally averaged to 05 marks.
- Project based learning shall be assessed for 05 Marks.
- In Project based learning, a student has to identify a problem such that at least 3 or 4 modular learning of experiments shall be integrated and submit comprehensive report with solution at the end of the semester.
- An internal assessment test conducted at the end of the semester shall be assessed for 05 marks.

Semester End Assessment:

- Semester end examination is for 35 marks (180 min) conducted and assessed by both external and internal examiners.
- Both internal and external examination shall include assessment of the student on
    a) Knowledge of principles/concepts involved
    b) Experimental design
    c) Result interpretation and analysis

d) Experimental report

c). **Drawing/Design/Estimation:**

i) Computer Aided Engineering Graphics:

Evaluation Procedure:

The course will have 5 units and assessed for 100 marks, of which, 30 marks for internal assessment and 70 marks for semester end external examination.

Internal Assessment : (30 Marks)

Continuous assessment : 10 Marks
Project based learning : 10 Marks
Internal Test : 10 Marks

Semester End Assessment:

- Semester end examination is for 70 marks (180 min) conducted and assessed by both external and internal examiners.
- Question paper contains 3 questions (with internal choice). **E**ach question carries 20 marks (5 marks for free hand drawing and list of commands & 15 marks for final drawing prepared in AUTOCAD). A Student shall answer all questions.
- Viva Voce for 10 Marks.

ii) Computer Aided Geometric Design and Assembly:

Evaluation Procedure:

The course will have 5 units and assessed for 50 marks, of which, 15 marks for internal assessment and 35 marks for semester end external examination.

Internal Assessment : (15 Marks)

Continuous assessment : 10 Marks
Project based learning : 05 Marks

Semester End Assessment:

- Semester end examination is for 35 marks (180 min) conducted and assessed by both external and internal examiners.
- Semester End Examination shall include assessment of the student on Final drawings like modeling, assembly and drafting.
- Student is expected to execute one exercise.
- Final drawings like modeling, assembly and drafting hard copies shall be evaluated by both internal and external examiners

iii) Design and Drawing Courses

Evaluation Procedure:

The course will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

Internal Assessment:	**40 Marks**
Subjective Test	- 20 Marks
Assignments	- 10 Marks
Design and Drawing reports	- 10 Marks

- Two subjective tests shall be conducted.
- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 7 marks (No choice) and the same shall be scaled down to 20 Marks.
- Average of two subjective tests shall be considered.
- Assignments shall be assessed for 10 marks.
- Design and drawing reports shall be assessed for 10 marks.

External Assessment:

The end examination question paper consists of Part A and Part B.

Part A consists of two questions regarding Design and Drawing (from two clusters clearly mentioned in the syllabus). Each question carries 20 marks. The student shall answer any 1 question.

Part B consists of four questions (from the remaining four clusters) with internal choice and all four are to be answered. Each question carries 10 marks.

iv) Estimation and Costing Courses

The course will have 5 units and assessed for 100 marks, of which, 40 marks for internal assessment and 60 marks for semester end external examination.

Internal Assessment:	**40 Marks**
Subjective Test	- 20 Marks
Assignments	- 10 Marks
Bar bending schedules,	- 10 Marks
Estimation and cost analysis reports	

Two subjective tests shall be conducted.

- Each subjective test shall be conducted for 90 Minutes and have 3 questions each for 7 marks (No choice) and the same shall be scaled down to 20 Marks.
- Average of two subjective tests shall be considered.
- Assignments shall be assessed for 10 marks.
- Bar bending schedules, Estimation and cost analysis reports shall be assessed for 10 marks.

External Assessment:

External examination is for 60 Marks. The question paper consists of 2 questions. Each question carries 60 Marks. The student shall answer 1 question.

In each question, the section, plan and reinforcement drawings of various members of a building will be given and the following items are to be calculated.

- Quantities of all the items (20 Marks).
- Reinforcement tonnage and Bar bending schedule (10 Marks).
- Specifications (10 Marks).
- Rates of all the items as per Standard Schedule of Rates (20 Marks).

Non Credit Mandatory Courses: The student has to secure 40% of the marks allotted in the internal evaluation for passing the course (Satisfactory or Not-Satisfactory). No marks or letter grade shall be allotted.

Procedure for conduct and Evaluation of MOOCs.:
The student shall register for the (Minimum of 12 weeks) offered by SWAYAM/NPTEL as Program elective/Open elective with the approval of the Head of the Department. The Head of the Department shall appoint one mentor for each MOOC. The student has to register the course in SWAYAM/NPTEL portal. The student has to submit the pass certificate issued by SWAYAM/NPTEL after completion of the course.

Socially Relevant Project:

- A student shall identify and provide a solution to the problem relevant to society/Profession/Industry.
- A student shall engage at least 15 hours on socially relevant project. Socially relevant project shall be evaluated internally for 50 marks by Project Review Committee (PRC). PRC comprising of HoD, department Academic Coordinator, R&D member of the department, one senior faculty and guide shall review the progress.

Mini Project:

- A student shall undergo internship for a period of 4 weeks/provide solution to the problem relevant to Industry/ Modern tool during the vacation after VI semester and submit comprehensive report.
  - Mini project shall be evaluated internally for 50 marks by Project Review Committee (PRC).
  - PRC shall prepare rubrics for assessment.

Project Evaluation:

Project is divided into 2 phases – Phase I & Phase II and assessed for 200 Marks.

- Evaluation shall comprise of internal and external assessment.

  Internal: 60 Marks

  External: 140 Marks

- A project Review committee (PRC) comprising of HoD, department Academic Coordinator, R&D member of the department, one senior faculty and guide shall review the progress once in four weeks.

Project Phase I:

- Project Phase I shall be evaluated along with Project Phase II.
- A student shall undertake project phase I during the VII semester.
- A student shall report to the guide/external supervisor and work under his supervision at least 2 hours per week.
- Assessment shall be on
  - Literature review
  - Identification and statement of the Problem

Project Phase II:

- A student shall undertake project phase II during the VIII semester.
- A student shall report to the guide/external supervisor and work under his supervision at least 8 hours per week.
- Internal evaluation shall be done by HoD, department Academic Coordinator, R&D member of the department, one senior faculty and guide for 60 marks.
- External evaluation shall be done by HoD, Guide/Internal Examiner and External Examiner for 140 marks.
- Assessment shall be on
  a) Review on fundamental knowledge involved
  b) Inter disciplinary aspect
  c) Experimental/methodology design
  d) Result analysis and interpretations
  e) Report writing
  f) Team work
  g) Presentation
  h) Viva-voce

B.Tech. (Lateral Entry):

The rules and regulations for candidates admitted under lateral entry category for 2^{nd}, 3^{rd} and 4^{th} years of study shall be same as applicable to regular B.Tech students.

7. ATTENDANCE REGULATIONS:

B.Tech.:

I. A student shall be eligible to appear for end semester examinations, if he or she acquires a minimum of 75% of attendance in aggregate of all the subjects (Theory & Lab.) for the semester.

II. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the college academic committee.

III. Shortage of attendance below 65% in aggregate of all the subjects (Theory & Lab) for the semester shall not be Condoned.

IV. Detained student shall seek re- admission for that semester when offered within 4 weeks from the date of commencement of class work.

PROMOTION RULE (Based on attendance):

- A Student shall be promoted to the next semester on fulfillment of minimum attendance requirement (75%) of current semester.

PROMOTION RULE (Based on credits):

- A student shall be promoted from IV semester to V semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits up to either III semester or IV semester from the following examinations irrespective of whether the candidate takes the examination or not.
    - Two regular and Two supplementary examinations of I semester
    - Two regular and One supplementary examinations of II semester
    - One regular examination and One supplementary examination of III semester
    - One regular examination of IV semester.
- A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits up to either V Semester or VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Three regular and Three supplementary examinations of I semester
- Three regular and Two supplementary examinations of II semester
- Two regular and Two supplementary examinations of III semester
- Two regular and One supplementary examinations of IV semester
- One regular and One supplementary examination of V semester
- One regular examination of VI semester.

B.TECH (Lateral Entry):

PROMOTION RULE (Based on attendance):

A Student shall be promoted to the next semester on fulfillment of minimum attendance requirement of current semester.

PROMOTION RULE (Based on credits):

A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits up to either V semester or VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Two regular and Two supplementary examinations of III semester
- Two regular and one supplementary examinations of IV semester
- One regular and One supplementary examinations of V semester
- One regular examination of VI semester.

B.Tech. (Lateral Entry):

The rules and regulations for candidates admitted under lateral entry category for 2nd, 3rd and 4th years of study shall be same as applicable to regular B.Tech students.

8. MINIMUM ACADEMIC REQUIREMENTS:

B.Tech.: (Theory/Lab)

i. A student is deemed to have satisfied the minimum academic requirements for a course on securing minimum 35% of marks in the semester end exam and minimum 40% of marks in the sum total of the internal marks and semester end marks.

B.Tech. (Lateral Entry):

The rules and regulations for candidates admitted under lateral entry category for 2nd, 3rd and 4th years of study shall be same as applicable to regular B.Tech students.

9. GRADING SYSTEM:

B.Tech. / B.Tech. (Lateral Entry)

Semester Grade Point Average (SGPA) for the current semester which is calculated on the basis of grade points obtained in all courses, except audit courses and courses in which satisfactory or course continuation has been awarded,

SGPA= Σ (course credits earned x Grade points) /
Σ (Total course credits in the semester.

CGPA= Σ (course credits earned x Grade points) up to successfully completed semesters) / Σ (Total course credits up to successfully completed)

The UGC recommends a 10-point grading system with the following letter grades as given below:

O	(Outstanding)	10
A+	(Excellent)	9
A	(Very Good)	8
B+	(Good)	7
B	(Above Average)	6
C	(Average)	5
P	(Pass)	4
F	(Fail)	0
Ab	(Absent)	0

- iii. A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥90	≥45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7

≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

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Illustration of Computation of SGPA and CGPA and Format for Transcripts

Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 X 8 = 24
Course 2	4	B+	7	4 X 7 = 28
Course 3	3	B	6	3 X 6 = 18
Course 4	3	O	10	3 X10 = 30
Course 5	3	C	5	3 X 5 = 15
Course 6	4	B	6	4 X 6 = 24
	20			**139**

Thus, **SGPA** =139/20 = 6.95

Illustration for CGPA

Semester 1	**Semester 2**	**Semester 3**	**Semester 4**	**Semester 5**	**Semester 6**
Credits: 16	Credits: 18	Credits: 25	Credits: 21	Credits: 23	Credits: 22
SGPA: 7.9	SGPA: 7.8	SGPA: 7.6	SGPA: 8.0	SGPA: 8.3	SGPA: 8.6

Semester 7	**Semester 8**
Credits: 21	Credits:14
SGPA: 8.2	SGPA: 8.5

Thus,

CGPA= $\frac{16x7.9 + 18x7.8 + 25x7.6 + 21x8.0 + 23x8.3 + 22x8.6 + 21x8.2 + 14x8.5}{\mathbf{160}}$ = **8.1**

10. ELIGIBILITY FOR AWARD OF DEGREE:

B.Tech:

A student shall be eligible for award of the degree if he/she fulfills the following conditions:

1) Successfully completes all the courses prescribed for the Program.
2) CGPA greater than or equal to 5.0 (Minimum requirement for Pass),

11. AWARD OF CLASS:

B.Tech:

Eligible Candidates for the award of B.Tech., Degree shall be placed in one of the following Classes based on CGPA.

CLASS	CGPA	Remarks
First Class with Distinction	≥ 7.75 (Without any Supplemenary appearance)	From the CGPA secured from 126 credits from III semester to VIII semester
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

12. CURRICULAR FRAMEWORK FOR HONORS PROGRAMME:

The goal of introducing B.Tech (Hons) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research. All the students pursuing regular B.Tech with prerequisite CGPA are eligible to register for Honors degree course. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the B.Tech Honors degree ie 180 credits.. The additional courses shall be advanced subjects in the concerned department/discipline. The department concerned will determine required courses for award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives

OBJECTIVES:

The objectives of initiating the B. Tech (Honors) degree are:

- To encourage the undergraduate students towards higher studies and Research
- To prepare the students to acquire specialized knowledge in core Engineering streams
- To attain the high-level competence in the specialized area of Under Graduate program.
- To learn the best educational and professional skills in the specialized area.
- To provide the opportunity to learn the post graduate level courses in the specified undergraduate program.

Applicability and Enrolment:

- To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
- The Honors degree will be offered at all JNTUK affiliated colleges (Autonomous and Non-Autonomous).
- The department offering Honors shall have at least one M. Tech in concerned stream, for B.Tech (Honors) registration.
- Total number of seats offered for a Honor program shall be a maximum of 35% of sanctioned intake .
- The allotment of seat into Honors degree is based on the percentage of marks obtained up to III semester in case of regular entry students and only III semester in case of lateral entry students
- In the event of any tie during the seat allotment for a Honors degree, the concerned major degree department offering Honor shall conduct a test/interview on the prerequisite subjects of Honors degree and final decision shall be taken.
- For applicability of Honors degree, both regular B Tech and Honors degree courses shall be successfully completed with specified SGPA/GCPA
- Transfer of credits from a particular minor to regular B. Tech or another major degree and vice versa shall not be permitted
- Institutions having at least two NBA accredited B.Tech/M.Tech programs can offer B.Tech(Honors) The Program departments should have valid NBA accreditation at the time of registration of the student for B.Tech (Honors).

Entry level:

- The B. Tech students (both Regular and Lateral Entry) pursuing a major degree

program can register for Honors degree.

- Students registering for Honors degree shall select the subjects from same branches/department based on the recommendations of BOS committee. For example, if a student pursumg major degree in Electrical & Electronics Engineering shall the selects subjects in Electrical & Electronics Engineering only and he/she will get major and Honors degree in Electrical & Electronics Engineering
- Only those students, who have a CGPA of 8.0 or above, without any backlog, will be permitted to register for a Honors degree
- An SGPA or CGPA in excess of 8.0 has to be maintained in the subsequent semesters in major as well as Honors degree without any backlogs in order to keep Honors degree registration active.
- Should both the SGPA and CGPA fall below 8.0 at any point after registering for the Honors, the Honors degree registration will cease to be active.
- A student registered for Honors degree in a discipline must register and pass in all subjects with a minimum GPA of 8.0 that constitute requirement for award of Honors degree.
- Separate SGPA/CGPA shall be shown on semester and final transcripts of regular B.Tech and Honor.
- Students shall not be permitted to register for Honors degree after completion of VI semester.
- Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for Honors degree.

- The students shall complete Honors degree without supplementary appearance within stipulated period as notified by JNTUK for the completion of regular major B. Tech. program.
- Honors degree shall not be awarded at any circumstances without completing the regular major B Tech program in which a student got admitted
- If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses for Honors degree
- If a student failed in any registered course of the Honors, he/she shall not be eligible to continue the B. Tech Honors. However, the additional credits and grades thus far earned - by the student shall be included in the grade card but

shall not be considered to calculate the CGPA.

- The subjects completed under Honors degree program shall not be considered as equivalent subjects in case the student fails to complete the major degree program.
- Students completed their degree shall not be permitted to register for Honors degree

Structure of Honors in B. Tech. :

- The student shall earn at least 20 credits for award of Honors degree from same branch/department/discipline registered for major degree
- Students can complete Honors degree courses either in the college or online from platforms like NPTEL/SWAYAM etc.
- Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses list in the departments, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two NPTEL, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.
- The overall attendance in each semester of regular B. Tech courses and Honors degree courses shall be computed separately
- A student shall maintain an overall attendance of 75% in all registered courses of Honors to be eligible for attending semester end examinations However, condonation for shortage of attendance between 65-75% may be given as per University norms. On the recommendations of College Academic Council, the student concerned will be permitted to take the semester end examinations, Student having less than 65% attendance in Honors courses shall not be permitted for semester end examinations.
- A student detained due to lack of attendance in regular B Tech program shall not be permitted to continue Honors program
- The teaching, examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses
- Students may choose theory or practical courses to fulfil the minimum credit requirement.
- Students shall be allowed to take maximum two subjects per semester pertaining to their Honors degree
- The students registered for Honors shall not be permitted to register for B. Tech

(Minors)

Credits requirement:

- A Student will be eligible to get B. Tech (Honors), if he/she completes an additional 20 credits. These may be acquired either in offline or online like NPTEL/SWAYAM
- The colleges offering Honors degree courses shall be ready teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies
- The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 12 weeks.
- The assessment and certification of the NPTEL shall be as per the prescribed norms of the NPTEL
- Students shall produce a certificate issued by the NPTEL/SWAYAM conducting agency as a proof of credit attainment.
- The teaching and evaluation procedure of Honors courses offering in offline mode shall be similar to that of regular B. Tech courses
- After successful completion of all major and Honors degree courses with specified CGPA the University will award B. Tech (Honors)
- If a student fails to complete a course offered in online/offline, he/she will not be permitted to continue the Honors degree

Procedure to Applying for Honors degree:

- The department offering the Honors will announce courses required before the start of the session.
- The interested students shall apply for the Honors course to the HOD of the concerned department
- The concerned department will announce the list of the selected students for the Honors.
- The whole process should be completed within one week before the start of every session.
- Selected students shall be permitted to register the courses for Honors degree.
- Each department offering the Honors degree shall submit the final list of selected students to the principal.
- The selected students shall submit a joining letter to the Principal through the

concerned HOD.

- The department offering Honors shall maintain the record of student pursing the Honors degree
- With the approval of Principal and suggestion of advisor/mentor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the Honor degree.

Allocation of seats for Honors:

- The University/institute/colleges will notify the number of the seats for Honor in the concerned department well in advance before the start of the semester
- Total number of seats offered for a Honor programme shall be a maximum of 35% of sanctioned intake.
- The list of the elective for Honor will be offered from the list of running majors in the concerned subjects. Each department of concerned institute will notify the seats for the minor well before the start of each session as per the following Table

S. No	S. No Name of the course	Sanction seats of major degree programme	Seats offered for minor	Courses offered	Credits for each course

Course Fees for registration of subjects in Major degree :

There is no fee for registration of subjects for major degree program offered in offline at the respective colleges.

Examinations:

(a) The examination for the Honors degree courses offered in offline shall be conducted along with regular B. Tech program.

(b) The examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses.

(c) A separate transcript shall be issued for the Honor subjects passed in each semester

(d) There is no supplementary examination for the failed subjects in a Honors degree program..

Examination Fees :

Examination Fees will be as per the JNTUK norms.

13. CURRICULAR FRAMEWORK FOR MINOR PROGRAMME:

The goal of introducing B.Tech. Minor is to facilitate the students to choose additional courses from other branches and some advanced subjects of their respective branch in which they are perusing the degree. This gives a provision to the students to pursue minor other than the discipline in which student got admitted. An aspiring student can choose the courses and laboratories in any other discipline and can get a minor in the chosen specialization in addition to regular major B Tech degree. This way undergraduates are not restricted to learn about courses only in the discipline they get admitted to, but can choose courses of their interest to later on take up a career path of their interest. The students taking up a minor course will get additional credits. A student has to acquire 20 more credits, in addition to 160 credits required for the award of the minor. The department concerned will determine the required courses for award of minor. The subjects in minor program would be a combination of mostly core and some electives of other departments..

OBJECTIVES:

The objectives of initiating the minor are.

- To diversify the knowledge of the undergraduates
- To make the undergraduates more employable.
- To have more educational and professional skills after the completion of his undergraduate courses
- To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

Applicability and Enrolment:

- To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
- The minor will be offered at all J.N.T. University affiliated colleges (Autonomous and Non-Autonomous).
- There shall be no limit on the number of programs offered under Minor. The minor programs in emerging technologies based on expertise in the respective departments may be offered and minor can also be offered in collaboration with the relevant industries/agencies.
- Total number of seats offered for a minor program shall be a maximum of 35% sanctioned intake of major degree program.

- If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- The allotment of seat into minor is based on the percentage of marks up to III semester in case of regular entry students and only III semester in case of lateral entry students
- For applicability of minor, both regular B Tech and minor courses shall be successfully completed with specified SGPA/CGPA
- Transfer of credits from a particular minor to regular B. Tech or another major degree and vice-versa shall not be permitted

Entry level:

- The B Tech students (both Regular and Lateral Entry) pursuing a major degree program can register for minor from III semester onwards.
- Students registering for minor shall select the subjects from other branches. For example, if a student pursuing major degree in Electrical & Electronics Engineering shall select the subjects specified for minor in Civil Engineering and he/she will get major degree of Electrical & Electronics Engineering with minor of Civil Engineering.
- Student pursuing major degree in any engineering branch is eligible to register for minor in any other engineering branch. However, students pursuing major degree in a particular Engineering are not allowed to register for minor in the same engineering branch.
- Only those students, who have a CGPA of 8.0 or above, without any backlog, will be permitted to register for a minor
- An SGPA or CGPA in excess of 8.0 has to be maintained in the subsequent semesters in major as well as minor without any backlogs in order to keep the minor registration active.
- Should both the SGPA and CGPA fall below 8.0 at any point after registering for the minor; the minor registration will cease to be active.
- A student registered for minor in a discipline must register and pass in all subjects with a minimum GPA of 8.0 that constitute requirement for award of minor.
- Separate CGPA shall be shown on semester and final transcripts of regular B. Tech and minor.

- Students shall not be permitted to register for minor after completion of VI semester.
- Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for minor.
- The students shall complete minor without supplementary appearance within stipulated period as notified by JNTUK for the completion of regular major B. Tech program.
- Minor shall not be awarded at any circumstances without completing the regular major B Tech program in which a student got admitted
- If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses of minor
- If a student failed in any registered course of the minor, he/she shall not be eligible to continue the B.Tech minor. However, the additional, credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA
- The subjects completed under minor program shall not be considered as equivalent subjects in case the student fails to complete the major degree program
- Students completed their degree shall not be permitted to register for minor

Structure of Minor in B. Tech:

- The student shall earn at least 20 credits for award of minor from other branch/department/discipline registered for major degree.
- Students can complete minor courses either in the college or in online from platforms like NPTEL/SWAYAM etc.
- The overall attendance in each semester of regular B. Tech courses and minor courses shall be computed separately
- A student shall maintain an overall attendance of 75% in all registered courses of minor to be eligible for attending semester end examinations. However, condonation for shortage of attendance between 65-75% may be given as per University norms. On the recommendations of College Academic Council, the student concerned will be permitted to take the semester end examinations Student having less than 65% attendance in minor courses shall not be permitted for end semester examinations

- A student detained due to lack of attendance in regular B. Tech program shall not be permitted to continue minor program
- The teaching, examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech courses
- The students may choose theory or practical courses to fulfill the minimum credit requirement.
- The students may be allowed to take maximum two subjects per semester pertaining to their minor
- The students are permitted to opt for only a single minor course in his/her entire tenure of B.Tech (Engineering)
- The students registered for B. Tech (Hons) shall not be permitted to register for minor
- The student is not permitted to take the electives courses from the parent department to fulfill the minimum credit requirement.

Credits requirement:

- A Student will be eligible to get minor along with major degree engineering, if he/she completes an additional 20 credits. These may be acquired either in offline or online like NPTEL/SWAYAM
- Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of minor, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two NPTEL, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.
- Curriculum and the syllabus of the courses shall be approved by the Board of Studies
- The online NPTEL/SWAYAM subjects selected by student shall be approved by concerned BOS. The duration of courses shall be a minimum of 12 weeks.
- The teaching and evaluation procedure of minor courses offering in offline mode shall be similar to that of regular B. Tech courses
- Students shall produce a certificate issued by the NPTEL/SWAYAM conducting agency as a proof of credit attainment
- The assessment and certification of the NPTEL shall be as per the prescribed norms of the NPTEL.

- After successful completion of all major and minor courses with specified CGPA the University will award both major and minors
- If a student fails to complete a course offered in online/offline, he/she will not be permitted to continue the minor

Procedure to Applying for the Minor :

- The department offering the minor will announce specialization and courses before the start of the session.
- The interested students shall apply through the HOD of his/her parent department
- The concerned department will announce the list of the selected students for the minor.
- The whole process should be completed within one week before the start of every session.
- Selected students shall be permitted to register the courses for minor

Registering for minor courses :

- Each department offering the minor will submit the final list of selected students to the principal.
- The selected students shall submit a joining letter to the Principal through the concerned HOD offering the minor. The student shall inform same to the HOD of his/her parent department.
- Both parent department and department offering minor shall maintain the record of student pursing the minor
- With the approval of Principal and suggestion of advisor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the minor.
- If the student wishes to withdraw/change the registration of subject/course, he/she shall inform the same to advisor, subject teacher, HODs of minor department and parent department and Principal within two weeks after registration of the course.

Procedure for Monitoring the Progress of the Scheme:

The students enrolled in the minor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

Allocation of seats for minor

- The University/institute/colleges will notify the number of the seats for minor in the concerned department well in advance before the start of the semester
- Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
- The list of the elective for minor will be offered from the list of running majors in the concerned subjects. Each department of concerned institute will notify the seats for the minor well before the start of each session as per the following Table

S. No	S. No Name of the course	Sanction seats of major degree programme	Seats offered for minor	Courses offered	Credits for each course

Course Fees for registration of subjects in Minor degree

There is no fee for registration of subjects for minor degree programme offered in offline at the respective colleges.

Examinations

- The examination for the minor courses offered in offline shall be conducted regular along with B. Tech programme.
- The examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech courses.
- A separate transcript shall be issued for the minor subjects passed in each semester
- There is no supplementary examination for the failed subjects in a minor program

14. INSTRUCTION DAYS:

A semester shall have a minimum of 90 clear instruction days (including internal examinations).

15. Transfers from other Institutions shall not be permitted.

16. SUPPLEMENTARY EXAMINATIONS:

Supplementary examinations shall be conducted within 4 weeks from the date of

announcement of results of regular examinations.

17. WITHHOLDING OF RESULTS: The result of a student shall be withheld

- If the student has not paid the dues, if any, to the institution
- If any case of pending disciplinary action ,
- Involvement in any sort of malpractices etc.
- Involvement in ragging.

18. TRANSITORY REGULATIONS:

a) Detained candidates are eligible for re-admission as and when next offered.

b) The re-admitted candidate will be governed by the rules and regulations under which the candidate has been admitted.

c) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. The transferred candidates have to write the backlogs/failed subjects, if any, in the same Institution where he/she was admitted.

19. AMENDMENTS **TO REGULATIONS:**

The Academic Council of MVGR College of Engineering (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations, and/ or Syllabi or any other such matter relating to the requirements of the program which are compatible to the contemporary/emerging trends effectively meeting the needs of society/industry/stake holding groups.

20. Regulations for MALPRACTICES during the conduct of examinations

	Nature of Malpractices/Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only. *
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any	Expulsion from the examination hall and cancellation of the

	other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. *
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled. *
3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider/candidate not on rolls, he will be handed over to the police and a case is registered against him. *
4	If the candidate mishandles the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination. Also if the answer script is mutilated / damaged disturbing the shape, of the script, answers, the bar code intentionally.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. He shall be debarred from class work and all examinations and be allowed to reregistered for the next subsequent odd or even semester only. The continuation of the course by the candidate is subject to the academic

		regulations in connection with forfeiture of seat.*

5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	The same should be brought to the notice of CE who in turn in consultation with malpractice committee makes decision for cancellation of the performance in that subject. *
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. *
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. *
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. *

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them. *
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. *
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.*

*

21. General :

- Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
- The academic regulation should be read as a whole for the purpose of any interpretation.
- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- The University 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 University.

* * *

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- **Ragging within or outside any educational institution is prohibited.**
- **Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student**

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	 1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	 2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	 5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	 10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE MVGR A RAGGING FREE CAMPUS

Ragging

ABSOLUTELY NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

PROGRAM STRUCTURE

B. TECH – CHEMICAL ENGINEERING

(A3 Regulation)

SEMESTER-I						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3MAT101	Mathematics-I	3	-	-	3
2	A3PYT101	Engineering Physics	3	-	-	3
3	A3CIT201	Programming for Problem Solving	3	-	-	3
4	A3MED201	Computer Aided Engineering Graphics	1	-	4	3
5	A3PYL101	Engineering Physics Laboratory	-	-	3	2
6	A3CIL201	Programming for Problem Solving Laboratory	-	-	3	2
7	A3EHA701	Constitution of India	2	-	-	0
Total number of Credits:						**16**
SEMESTER-II						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3MAT102	Mathematics-II	3	-	-	3
2	A3CYT101	Engineering Chemistry	3	-	-	3
3	A3EET201	Basic Electrical Engineering	3	-	-	3
4	A3EHL001	Essential Communication in English	1	-	3	3
5	A3CYL101	Engineering Chemistry Laboratory	-	-	3	2
6	A3EET201	Basic Electrical Engineering Laboratory	-	-	3	2
7	A3CHW201	Workshop	-	-	3	2
Total number of Credits:						**18**
SEMESTER-III						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3CHT101	Biology for Engineers	3	-	-	3
2	A3MAT105	Mathematics-III	3	-	-	3
3	A3CHT202	Design Thinking and Product Innovation	3	-	-	3
4	A3CHT301	Chemical Technology	3	-	-	3
5	A3CHT302	Fluid Mechanics for Chemical Engineers	3	-	-	3
6	A3CHT201	AI Tools, Techniques and Applications	3	-	-	3
7	A3CHL301	Fluid Mechanics Laboratory	-	-	3	1.5
8	A3CHL302	CHEM CAD Lab Laboratory	-	-	3	1.5
9	A3CHL201	AI Tools, Techniques and Applications Lab	-	-	3	2
10	A3EHA702	Essence of Indian Traditional Knowledge	2	-	-	0
Total number of Credits:						**23**

SEMESTER-IV						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3EHT001	Effective Technical Communication	2	-	2	3
2	A3MAT110	Mathematics-IV	3	-	-	3
3	A3CHT201	Internet of Things	2	-	2	3
4	A3CHT303	Chemical Process Calculations	3	-	-	3
5	A3CHT304	Mechanical Unit Operations	3	-	-	3
6	A3CHT305	Process Heat Transfer	3	-	-	3
7	A3CHL303	Mechanical Unit Operations Lab	-	-	3	1.5
8	A3CHL304	Process Heat Transfer Lab	-	-	3	1.5
9	A3CHP602	Mini Project	-	-	4	2
10	A3CHA701	Environmental Science	2	-	-	0
Total number of Credits:						**23**

SEMESTER-V						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3CHT306	Chemical Engineering Thermodynamics	3	-	-	3
2	A3CHT307	Chemical Reaction Engineering - I	3	-	-	3
3	A3CHT308	Mass Transfer - I	3	-	-	3
4 (PE-1)	A3CHT401	New Material Technology	3	-	-	3
	A3CHT402	Fertilizer Technology				
	A3CHT403	Polymer Technology				
5 (OE-1)	A3MST002	OE-I: Human Resources Development and Organizational Behavior	3	-	-	3
6 (OE-2)	A3XXT5XX	Open Elective - 2	3	-	-	3
7	A3CHL305	Chemical Reaction Engineering Lab	-	-	3	1.5
8	A3CHL306	Mass Transfer Lab	-	-	3	1.5
Total number of Credits:						**21**

SEMESTER-VI						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3MST001	Managerial Economics and Financial Analysis	3	-	-	3
2	A3CHT309	Chemical Reaction Engineering - II	3	-	-	3
3	A3CHT310	Mass Transfer - II	3	-	-	3
4	A3CHT311	Process Instrumentation and Control	3	-	-	3
5	A3CHT312	Process Modeling & Simulation	3	-	-	3
6 (PE-2)	A3CHT404	Petroleum Refining	3	-	-	3
	A3CHT405	Petro Chemical Technology				
	A3CHT406	Fuel Cell Technology				
7 (PE-3)	A3CHT407	Phase & Reaction Equilibria	3	-	-	3
	A3CHT408	Corrosion & Control				
	A3CHT409	Process Intensification				
8	A3CHL307	Process Instrumentation and Control Lab	-	-	3	1.5
9	A3CHL308	Process Modeling & Simulation Lab	-	-	3	1.5
Total number of Credits:						**24**

SEMESTER-VII						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3EHT002	Professional Ethics and Human Values	3	-	-	3
2	A3CHT313	Plant Design and Economics	3	-	-	3
3	A3CHT314	Transport Phenomena	3	-	-	3
4 (PE-4)	A3CHT410	Food Processing Technology	3	-	-	3
	A3CHT411	Nano Technology				
	A3CHT412	Pharmaceutical Technology				
5 (PE-5)	A3CHT413	Bio Chemical Engineering	3	-	-	3
	A3CHT414	Enzyme Engineering				
	A3CHT415	Nuclear Reactor Engineering				
6 (PE-6)	A3CHT416	Industrial Bio Technology	3	-	-	3
	A3CHT417	Industrial Safety & Hazard Management				
	A3CHT418	Optimization of Chemical Processes				
7	A3CHP601	Socially Relevant Project	-	-	2	1
8	A3CHP603	Project (Phase-I)	-	-	4	2
Total number of Credits:						**21**

SEMESTER-VIII						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1 (OE-3)	A3CHT507	Energy Engineering	3	-	-	3
	A3CHT508	Bio Energy				
	A3CHT509	Energy Conservation and Management				
2 (OE-4)	A3CHT510	Environmental Impact Assessment	3	-	-	3
	A3CHT511	Solid Waste Management				
	A3CHT512	Industrial Pollution Control & Engineering				
3	A3CHP604	Project (Phase-II)	-	-	16	8
Total number of Credits:						**14**

Note: Each department is offering 4 open elective courses. One elective course is from Humanities (Human Resources Development and Organizational Behavior) which is common to all Engineering departments. 2nd Open elective course should be opted from the other departments (List of Open elective courses offered by various departments are given below). 3rd and 4th Open elective courses (Emerging subjects) should be discipline centric.

OPEN ELECTIVES

OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF CIVIL ENGINEERING						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3CET501	Remote Sensing and GIS	3	-	-	3
2	A3CET502	Project Planning and Management	3	-	-	3
3	A3CET503	Road Safety Engineering	3	-	-	3
4	A3CET504	Geomatics	3	-	-	3
5	A3CET505	Building Services	3	-	-	3
6	A3CET506	Water Power Engineering	3	-	-	3
OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF EEE						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3EET501	Basic Control Systems				
2	A3EET502	Applied Electrical Engineering				
3	A3EET503	Electrical Safety				
4	A3EET504	Concepts of Electrical Wiring				
5	A3EET505	Basic Automation Course				
6	A3EET506	Illumination Engineering				
OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF MECHANICAL ENGINEERING						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3MET501	Introduction to Robotics	3	-	-	3
2	A3MET502	Solar and Wind Energy	3	-	-	3
3	A3MET503	Production and Operations Management	3	-	-	3
4	A3MET504	Micro Electromechanical Systems	3	-	-	3

5	A3MET505	Product Lifecycle Management	3	-	-	3
6	A3MET506	Foundation of Computational Fluid Dynamics	3	-	-	3
OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF ECE						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3ECT501	Principles of Communication Engineering	3	-	-	3
2	A3ECT502	Electronic Instrumentation	3	-	-	3
3	A3ECT503	Biomedical Engineering	3	-	-	3
4	A3ECT504	Modern Communication Systems	3	-	-	3
5	A3ECT505	Transducers and Sensors	3	-	-	3
6	A3ECT506	Principles of Mobile Communications	3	-	-	3
OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF CSE & IT						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3CIT501	Fundamentals of Data Structures	3	-	-	3
2	A3CIT502	Object Oriented Programming with JAVA	3	-	-	3
3	A3CIT503	Web Design and Development	3	-	-	3
4	A3CIT504	Python Programming	3	-	-	3
5	A3CIT505	NoSQL Databases	3	-	-	3
6	A3CIT506	Data Analytics	3	-	-	3
OPEN ELECTIVE COURSES OFFERED BY THE DEPARTMENT OF CHEMICAL ENGINEERING						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	A3CHT501	Computational Fluid Dynamics	3	-	-	3
2	A3CHT502	Non-Conventional Sources of Energy	3	-	-	3
3	A3CHT503	Design & Analysis of Experiments	3	-	-	3
4	A3CHT504	Industrial Waste Water Engineering	3	-	-	3
5	A3CHT505	Green Chemistry & Technology	3	-	-	3
6	A3CHT506	Air Pollution Control and Design of Equipment	3	-	-	3

A3MAT101	SEMESTER - I	L	T	P	C
	MATHEMATICS-I (common to ALL branches)	3	1	-	3
	Total Contact Hours – 48				

SYLLABUS

UNIT-I: LINEAR ALGEBRA-1

Rank of a matrix: Elementary row and column transformations, equivalent matrices, Echelon form of a matrix, calculation of rank by reducing the matrix to Echelon form. System of equations: Linear system of equations, homogeneous and non-homogeneous system of equations, consistency criteria, trivial and non-trivial solutions, solving system of equations by Rank method; Eigenvalues and Eigenvectors: Finding Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors (statements) including spectral mapping theorem.

UNIT- II: LINEAR ALGEBRA-2

Cayley-Hamilton Theorem: Statement of the theorem and its verification. Applications: Finding higher powers of a matrix, finding matrix polynomials, finding inverse of matrix. Diagonal form of a matrix: Reduction to diagonal form, spectral and modal matrices, finding higher powers of a matrix using diagonalisation, Quadratic forms: Matrix form of quadratic forms, orthogonal transformation, canonical form, reduction of quadratic form to canonical form by orthogonal transformation method, rank, index, signature and nature (definiteness) of a quadratic form.

UNIT-III: FIRST ORDER DIFFERENTIAL EQUATIONS & APPLICATIONS

Outlines: Differential Equations(DEs), Order and degree of a DE, Formation of DEs, general solutions of a DE; Solving first order and first degree DEs: linear DEs, Bernoulli's DEs (reducible to linear), exact DEs, integrating factors, non-exact DEs (reducible to exact).

Applications to real world problems: Newton's law of cooling, laws of growth and decay, family of curves, orthogonality of families curves, orthogonal trajectories (Cartesian and polar curves).

UNIT-IV: HIGHER ORDER DIFFERENTIAL EQUATIONS

Differential equations of higher order: Linear differential equations of higher order, its operator form. Solution concepts: General (complete) solution, particular solution. Solution of linear differential equations of higher order: Auxiliary equations, rules for finding complementary functions, rules for finding particular integrals (general and special methods).

UNIT-V: LAPLACE TRANSFORMS

Laplace transformation: Laplace transformation of elementary functions, Properties: Linearity, change of scale, first shifting properties, finding Laplace transformations using properties, Advanced properties: Laplace transformations of derivatives and integrals, multiplication by t^n, division by t (statements), finding Laplace transformations using advanced properties; Inverse Laplace transformations: Finding inverse Laplace transformations using partial fractions, statement of Convolution theorem, finding inverse Laplace transformations by Convolution theorem; Applications: Solving Initial Value Problems by using Laplace transformations.

//Topics prefixed with ‘outlines / overview’ are not for assessment//

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
2. T.K.V. Iyengar et al, Engineering Mathematics, S. Chand Publishers, Revised edition

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
3. T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

COURSE OUTCOMES: Learners at the end of this course will be able to

CO 1	KO#1	Recall the concepts of Linear algebra
CO 2	KO#2	Recall the solution methods and applicability of first order differential equations
CO 3	KO#3	Recall the solution methods of higher order differential equations and the concepts of Laplace transforms
CO 4	UO#1	Use and interpret the concepts of linear algebra
CO 5	UO#2	Use and interpret solution methods and applicability of first order differential equations
CO 6	UO#3	Use and interpret solution methods of higher order differential equations and the concepts of Laplace transforms
CO 7	AO#1	Apply the concepts of linear algebra, differential equations and Laplace transformation to model and solve real world problems

CO/PO Mapping

Course Title:	Mathematics-I (Common to ALL Branches)													
Course Code:	A3MAT101													
Course Designed by	Dept. of Mathematics													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2							2			
CO2	3	3		2							2			
CO3	3	3		2							2			
CO4	3	3		2							2			
CO5	3	3		2							2			
CO6	3	3		2							2			
CO7	3	3		2							2			

Course designed by	DEPARTMENT OF MATHEMATICS
Approval	Approved by: Meeting of Board of Studies held on 06.07.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3PYT101	SEMESTER – I	L	T	P	C
	ENGINEERING PHYSICS (COMMON TO CE, ME & CHEM)	3	-	-	3
	Total Contact Hours – 48				

SYLLABUS

Unit – I: CRYSTALLOGRAPHY [8 hrs]

Introduction- Crystal systems- Bravais lattices- Packing fractions of simple, body centered, face centered cubic structures - Directions and Planes in crystals- Miller indices- Inter planar spacing- Bragg's Law of X-Ray diffraction- Powder X-Ray diffraction method.

Unit –II: LASER & FIBER OPTICS [10hrs]

LASER: Introduction- Absorption, Spontaneous and stimulated emission of radiation- Einstein coefficients- Population inversion- Basic components of laser- Nd YAG Laser – CO_2 Laser- Applications of LASER.

FIBER OPTICS: Introduction- Principle of optical fiber- Numerical Aperture- Acceptance angle- Classification of optic fibers- Applications of fibers.

Unit-III: ULTRASONICS & ACOUSTICS [10hrs]

Ultrasonics-Introduction- Properties of ultrasonic sounds- Generation of Ultrasonic sounds- Magnetostriction- Piezoelectric effect- Detection- Kunts tube- Converse piezoelectric method- Ultrasonic Nondestructive testing technique (pulse-echo technique under reflection mode)- Applications.

ACOUSTICS- Introduction– Reverberation- Reverberation time- Sabines formula for reverberation time- Absorption coefficient and its measurement- Factors effecting acoustic design of hall.

Unit – IV: THERMODYNAMICS [10hrs]

Introduction- First Law- Isothermal process- Adiabatic process- Work done- Second Law- Carnot's heat engine- Efficiency- Entropy- Physical significance- Entropy and second law- Temperature entropy diagram- Third Law of Thermodynamics- Applications of thermodynamics.

Unit – V: PRINCIPLES OF MECHANICS [10hrs]

Introduction- System of forces- Resultant of coplanar forces- Method of resolution- Parallel forces- Moment of force- Varignon theorem- Force system in space- Friction- Limiting friction & Impending motion- Coulomb's laws of dry friction- Coefficient of friction- Cone of friction- Types of friction (qualitative).

TEXTBOOKS

1. Engineering Physics by R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications.

REFERENCES

1. RESNICK, HALLIDAY and WALKER, Principles of Physics, Wiley Publishers
2. A.NELSON, Engineering Mechanics: Statics & Dynamics by, Tata Mc Graw Hill Publishers.
3. P.K. NAG, Engineering Thermodynamics, Mc. Graw Hill Publishers

COURSE OUTCOMES:

CO1. The student will be able to recognize the underlying principles of crystalline solids, LASER production and Optical fibers

CO2. The student will be able to gain knowledge on the fundamentals of acoustics and production & detection of ultrasonics
CO3. The student will be able to describe the essentials of thermodynamics, force systems and friction.
CO4. The student will be able to understand crystal structures and X-ray diffraction as a tool for crystal structure analysis.
CO5. The student will be able to understand the importance of industrially relevant LASERS, applications of optical fibers and the prominence of ultrasonics in nondestructive testing.
CO6. The student will be able to understand basic processes involved in thermo-dynamical systems and force systems
CO7. The student will have the ability to apply the conceptual knowledge of forces and its related physical quantities in solving engineering problems.

CO/PO MAPPING:

Course Title:	Engineering Physics													
Course Code:	A3PYT101													
Course Designed by	Dept. of Physics													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3						1				1		
CO2	3	3						1				1		
CO3	3	3						1				1		
CO4	3	3						1				1		
CO5	3	3						1				1		
CO6	3	3						1				1		
CO7	3	3						1				1		

Course designed by	DEPARTMENT OF PHYSICS
Approval	Approved by: Meeting of Board of Studies held on 29.06.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3CIT201	SEMESTER – I	L	T	P	C
	PROGRAMMING FOR PROBLEM SOLVING	3	-	-	3
	Total Contact Hours : 54				
	Prerequisites: Mathematics				

SYLLABUS

UNIT – I: [9 HOURS]

INTRODUCTION: Introduction to Programming, Computer System, Hardware and Software concepts.

PROBLEM SOLVING: Algorithm, Pseudo-code, flow-chart, program development steps, high-level, Assembly and machine languages.

BASICS OF C PROGRAMMING: Structure of C program, identifier, basic data types and sizes, constants, variables, arithmetic operators, relational operators, logical operators, increment and decrement operators, assignment operator, conditional operator, scanf and printf built-in functions, Creating and running programs.

UNIT – II: [9 HOURS]

BIT-WISE OPERATORS: logical, shift, rotation, masks.

EXPRESSIONS: expressions, type conversions, conditional expressions, precedence and order of evaluation.

SELECTION: Two-way selection: if-else, nested if, examples, multi-way selection: switch, else-if, examples.

ITERATIVE: loops - while, do-while and for statements, break continue, event and counter controlled loops.

UNIT – III: [18 HOURS]

Part – I: [9 HOURS]

ARRAYS: Arrays (1-D, 2-D), Character arrays and Strings, Searching (Linear Search and Binary Search).

Part – II: [9 HOURS]

BASIC ALGORITHMS: Basic Sorting Algorithms (Bubble, Insertion and Selection), comparing algorithms for complexity.

FUNCTIONS: Functions, Scope and Extent of Variables, Function Parameters, parameter passing using call-by-value, sub-routines, Storage Classes,#define,#ifdef, #ifndef pre-processor directives.

UNIT – IV: [9 HOURS]

RECURSION: Definition of Recursion, example programs using recursion like finding Factorial, Fibonacci series, Quick sort, puzzle solving using recursive functions (towers of hanoi, ackerman function).

POINTERS: Definition of Pointers, Pointer Type, Pointer Arithmetic, Function parameter passing using call-by-reference.

MEMORY ALLOCATION: Difference between static and dynamic memory allocation, dynamic memory allocation using built-in functions, dangling pointer, unreferenced memory problem.

UNIT – V: [9 HOURS]

ENUMERATED, STRUCTURE AND UNION TYPES: Derived types- structures-declaration, definition and initialization of structures, accessing structures, nested structures,

arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, bit-fields, concept of linked list, program applications.
FILE-HANDLING: Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, command line arguments.

Suggested Text Books

1. Programming For Problem Solving, Behrouz A.Forouzan & Richard F.Gilberg, Cengage Publishers, 3rd Edition
2. Programming In C:A Practical Approach, Ajay Mittal, Pearson Education

Suggested Reference Books

1. Brian W. Kernighan And Dennis M. Ritchie, The C Programming Language, Prentice Hall Of India
2. Introduction To C Programming, Reema Thareja, Oxford University Press
3. E. Balaguruswamy, Programming In Ansi C, Tata Mcgraw-Hill

COURSE OUTCOMES

The student will

1. Have the ability to **describe** a formal algorithmic solution for the given problem, **list** the features of C including scalar & vector data types, operators, **Outline** expressions, expression evaluation, operator precedence, sequential, conditional & iterative constructs.

2. Have the ability to **describe** one and two-dimensional arrays, **outline** loops and arrays for searching and **describe** various sorting techniques.

3. Have the ability to **outline** the purpose of functions, pointers, command line arguments, dynamic memory allocation. **Define** storage classes. **Describe** command like arguments, structures, unions, and enumeration. Have knowledge of handling files.

4. Have the ability to **solve** complex expressions, **design** algorithms and **develop** programs in C language using the basic constructs, data types, operators, control & iterative statements, and arrays.

5. Have the ability to **apply** arrays to solve complex matrix related problems and strings. **Compare and contrast** various searching and sorting techniques for complexity.
6. Have the ability to **distinguish between** function call types. **Draw inferences on** command line arguments, storage classes, and pre-processor directives. **Use** pointers with functions, arrays, strings, to **solve** complex problems. **Give example** and **solve** classical recursion problems**. Compare and contrast** static and dynamic memory allocation, and **apply** them. **Use** structures and unions to implement and **solve** real-time problems. **Apply** file related functions to process files.

7. Have the ability to **Fully appreciate** the art of procedural programming in C and develop programs **optimally** using the full feature set of C language.

Course Title:	Programming for problem solving (Common to ALL Branches)														
Course Code:	A3CIT201														
Course Designed by	Dept. of Computer Science and Engineering														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOM	PSON	PSOO
CO1	3	3						3	2	1		2	1	1	1
CO2	3	3						3	2	1		2	1	1	1
CO3	3	3						3	2	1		2	1	1	1
CO4	3	3	3	3	3	3	3	3	2	1	1	2	3	3	3
CO5	3	3	3	3	3	3	3	3	2	1	1	2	3	3	3
CO6	3	3	3	3	3	3	3	3	3	1	1	2	3	3	3
CO7	3	3	3	3	3	3	3	3	3	1	1	3	3	3	3

Levels of Correlation: High-3, Medium-2, Low-1

A3MED201	SEMESTER - I	L	T	P	C
	COMPUTER AIDED ENGINEERING GRAPHICS	1	-	4	3
	Total Contact Hours – 60				

SYLLABUS

UNIT-I

Overview of Computer Graphics:

Computer technologies that impact on graphical communication, Demonstrating knowledge of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

Set up of the drawing page and the printer, Scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing.

Applying dimensions to objects, applying annotations to drawings;

UNIT-II

Layers: Setting up and use of Layers, layers to create drawings, create, edit and use customized layers, concept of view ports.

Introduction to Orthographic Projections: Projections of Points; Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane.

UNIT-III

Projections of Straight Lines and Planes: Lines inclined to both planes, determination of true lengths, angle of inclinations and traces, Projections of Planes

UNIT-IV

Projections and sections of solids: Projections of simple solids- Sections of solids

UNIT -V

Development of surfaces, Isometric Projection and Conversion of Isometric Views to Orthographic Views: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa

TEXT BOOKS

1. DM Kulkarni, AP Rastogi, AK Sarkar “Engineering graphics with Auto CAD” PHI Publishers
2. Bhatt N.D., Panchal V.M. & Ingle P.R “Engineering Drawing” Charotar Publishing House.

REFERENCE BOOKS

1. Shah, M.B. & Rana B.C “Engineering Drawing and Computer Graphics”, Pearson Education.
2. Agrawal B. & Agrawal C. M “Engineering Graphics”, TMH Publication.
3. Narayana, K.L. & P Kannaiah “Engineering Drawing”, SciTech Publishers.
4. CAD Software Theory and User Manuals.

COURSE OUTCOMES

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

CO1: Prepare two dimensional drawings using draw and modify commands in Auto CAD software and represent dimensions to the drawings

CO2: Clearly differentiate different types of projections and get solutions to projections of points in Auto CAD by applying the layers concept

CO3: Solve problems related to projections of straight lines and planes

CO4: Prepare simple solids in CAD software and obtain solutions to projections and sections of solids

CO5: Develop the surfaces of simple solids, prepare Isometric drawings and convert isometric drawings into orthographic views

CO/PO Mapping

Course Title:	Computer Aided Engineering Graphics													
Course Code:	A3MED201													
Course Designed by	Dept. of Mechanical Engineering													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		3	1		1	2	3	2	2	3	2
CO2	3	2	2		3	1		1	2	3			2	1
CO3	3	2	2		3	1		1	2	3			2	1
CO4	3	2	3		3	1		1	2	3	2	2	3	1
CO5	3	2	3		3	1		1	2	3	2	2	3	1

Course designed by	DEPARTMENT OF MECHANICAL ENGINEERING
Approval	Approved by: Meeting of Board of Studies held on 29-06-2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3PYT101	SEMESTER – I	L	T	P	C
	ENGINEERING PHYSICS LAB	-	-	3	2
	Total Contact Hours – 42				

LIST OF EXPERIMENTS

1.	Determination of size of the micro dimensional system by Laser diffraction.
2.	Determination of numerical aperture and acceptance angle of the optic fiber.
3.	Determination of lattice constants of the crystal systems.
4.	Verification of laws of transverse vibrations in stretched strings by using Sonometer.
5.	Determination of velocity of ultrasonic sounds in liquids by acoustic grating method
6.	Determination of thermal conductivity coefficient of the disc shaped material.
7.	Determination of specific heat of the given liquid by Newton's law of cooling principle.
8.	Determination of temperature coefficient resistance for the thermistor.
9.	Determination of the static friction coefficient.
10.	Determination of rigidity modulus of the wire shaped material by using Torsional pendulum.

TEXTBOOKS:

1. BALASUBRAMANIAN.S, SRINIVASAN.M..N, A Text book of Practical Physics, S Chand Publishers, 2017

REFERENCES:

1. https://vlab.amrita.edu.

COURSE OUTCOMES:

CO1. Design experiments to determine the size of the micro-dimensional system and the parameters impelling communication through optic fibre.

CO2. Investigate the powder X-Ray diffraction patterns for crystal structure analysis.

CO3. Design experiments for demonstration of mechanical resonance and determine the velocity of ultrasonic sounds in liquid media.

CO4. Design experiments to determine physiognomies of materials like the thermal conductivity coefficient (*K*), specific heat (s) and temperature coefficient of resistance (α).

CO5 Design experiments to determine the mechanical properties like the rigidity modulus (η) and the static friction coefficient (μ_s).

CO/PO MAPPING:

Course Title:	Engineering Physics Lab													
Course Code:	A3PYT101													
Course Designed by	Dept. of Physics													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3						1	2	1		1		
CO2	3	3						1	2	1		1		
CO3	3	3						1	2	1		1		
CO4	3	3						1	2	1		1		
CO5	3	3						1	2	1		1		

Course designed by	DEPARTMENT OF PHYSICS
Approval	Approved by: Meeting of Board of Studies held on 29.06.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3CIL201	SEMESTER – I	L	T	P	C
	PROGRAMMING FOR PROBLEM SOLVING	-	-	3	2
	Total Contact Hours : 54				
	Prerequisites: Mathematics				

UNIT – I

WEEK 1:

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using computers

Lab1: Familiarization with programming environment

i) Exposure to Turbo C, gcc, Code Blocks IDE
ii) Writing simple programs using printf(), scanf()

WEEK 2:

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments/Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts

Lab1: Converting algorithms/flowcharts into C Source code

Developing the algorithms/flowcharts for the following sample programs

i. Sum and average of 3 numbers
ii. Conversion of Fahrenheit to Celsius and vice versa
iii. Simple interest calculation

WEEK 3:

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT – II

WEEK 4:

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial 4: Operators and their precedence and associativity:

Lab 4: Simple computational problems using the operator's precedence and associativity

i) Evaluate the following expressions
   a. A+B*C+(D*E)+F*G
   b. A/B*C-B+A*D/3
ii) a. A+++B---A
   b. J=(i++)+(++i)

iii) Find the maximum of three numbers using conditional operator
iv) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5:
Objective: Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures

i) Write a C program to find the max and min of four numbers using if-else
ii) Write a C program to generate electricity bill
iii) Find the roots of the quadratic equation
iv) Write a C program to simulate a calculator using switch case
v) Write a C program to find the given year is a leap year or not

WEEK 6:
Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.
Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops:
Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop
ii) Find the given number is a prime or not
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers

UNIT – III

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1D Arrays: searching
Lab 7: 1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array
ii) Perform linear search on1D array
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number
v) Eliminate duplicate elements in an array

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that

will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2D arrays, Sorting and Strings

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT-IV

WEEK 9:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 9: Functions, call by value, scope and extent,

Lab 9: Simple functions using call by value, Solving differential equations using Eulers theorem

i) Write a C function to calculate NCR value
ii) Write a C function to find the length of a string
iii) Write a C function to transpose of a matrix
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 10:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 10: Recursion, the structure of recursive calls

Lab 10: Recursive functions

i) Write a recursive function to generate Fibonacci series
ii) Write a recursive function to find the lcm of two numbers
iii) Write a recursive function to find the factorial of a number
iv) Write a C Program to implement Ackermann function using recursion
v) Write a recursive function to find the sum of series.

WEEK 11:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 11: Call by reference, dangling pointers

Lab 11: Simple functions using Call by reference, Dangling pointers

i) Write a C program to swap two numbers using call by reference
ii) Demonstrate Dangling pointer problem using a C program

iii) Write a C program to copy one string into another using pointer
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

UNIT – V

WEEK 12:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc(), calloc(), realloc() and free() functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 12: Pointers, structures and dynamic memory allocation

Lab 12: Pointers and structures, memory dereference

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 13:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly-linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 12: Bitfields**,** Self-Referential Structures, Linked lists

Lab 12: Bitfields, linked lists

i) Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields
ii) Create and display a singly linked list using self-referential structure
iii) Demonstrate the differences between structures and unions using a C program
iv) Write a C program to shift/rotate using bitfields
v) Write a C program to copy one structure variable to another structure of the same type.

WEEK 14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling:

Lab 14: File operations

i) Write a C program to write and read text into a file
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file
iv) Write a C program to merge two files into the third file using command-line arguments
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

TEXTBOOKS:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

COURSE OUTCOMES

CO1.	**Demonstrate** the ability to write a formal algorithmic solution for the given problem, **name & explain** the features of C like types including scalar & vector types, operators, expressions, expression evaluation, operator precedence, sequential, conditional & iterative constructs.
CO2.	**Implement** one and two-dimensional arrays to solve simple mathematical and matrix related problems. **Make use of** loops and arrays for searching and **Compare** various sorting techniques.
CO3.	**Identify** the purpose of functions, pointers, command line arguments, dynamic memory allocation. **Define** storage classes. **Understand** command like arguments, structures and unions. Have **knowledge** of handling files.
CO4.	**Design** algorithms and **develop** programs in C language using the basic constructs, data types, operators, control statements, and arrays.
CO5	**Apply** pointers, functions, derived data types, and dynamic memory allocation, **design** solutions to challenging problems.
CO6	**Illustrate** the art of procedural programming in C and **develop** programs optimally using the full feature set of C language.

Course Title:	Programming for problem solving lab (Common to ALL Branches)														
Course Code:	A3CIL201														
Course Designed by	Dept. of CSE & IT														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	3	1	1	1	2	2			2	2	2
CO2	3	3	1	2	3	1	1	1	2	2			2	2	2
CO3	3	3	2	3	3	2	1	1	2	2			3	3	3
CO4	3	3	2	3	3	3	1	1	2	2			3	3	3
CO5	3	3	3	3	3	3	1	1	2	2			3	3	3
CO6	3	3	3	3	3	3	1	1	3	3	3		3	3	3

Levels of Correlation: High-3, Medium-2, Low-1

Course designed by	DEPARTMENTS OF CSE & IT
Approval	Approved by: Meeting of Board of Studies held on 29-06-2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019

A3EHA701	SEMESTER - I	L	T	P	C
	CONSTITUTION OF INDIA	2	-	-	0
	Total Contact Hours – 30				

SYLLABUS

UNIT – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History - Drafting Committee, (Composition & Working)

UNIT – II: PHILOSOPHY OF THE INDIAN CONSTITUTION: Preamble - Salient Features

UNIT-III: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES: Fundamental Rights -Right to Equality -Right to Freedom -Right against Exploitation -Right to Freedom of Religion -Cultural and Educational Rights -Right to Constitutional Remedies ; Directive Principles of State Policy ; Fundamental Duties.

UNIT-IV: ORGANS OF GOVERNANCE: Parliament -Composition - Qualifications and Disqualifications - Powers and Functions - Executive - President - Governor - Council of Ministers; Judiciary, Appointment and Transfer of Judges, Qualifications.
UNIT – V: LOCAL ADMINISTRATION: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat : Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

TEXT BOOK:
Reference Source compilation

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

COURSE OUTCOMES:

CO1. Students will be able to discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2. Students will be able discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3. Students will be able to discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP]under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO4. Students will be able to discuss the passage of the Hindu Code Bill of 1956.

CO5. Students will be able to discuss the powers of Executive, Judiciary and Legislature.

CO/PO Mapping

Course Title:	Constitution of India (Common to ALL Branches)													
Course Code:	A3EHA701													
Course Designed by	Dept. of English & Humanities													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2								
CO2						2								
CO3						2								
CO4						2								
CO5						2								

Course designed by	DEPARTMENT OF ENGLISH & HUMANITIES
Approval	Approved by: Meeting of Board of Studies held on 23.06.15
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

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A3MAT103	SEMESTER - II	L	T	P	C
	MATHEMATICS-II (CSE & IT)	3	1	0	3
	Total Contact Hours – 48				

SYLLABUS

UNIT-I: RANDOM VARIABLES & PROBABILITY DISTRIBUTIONS

Random Variables: Discrete and continuous random variables, properties of mass and density functions. Mathematical Expectation: Properties (statements), Moment Generating Function; Outlines: of Binomial and Poission distributions; Normal Distribution: Probability density function, Normal approximation to Binomial Distribution, Parameters of Normal Distribution(statements), Characteristics of normal distribution, Area under normal curve, Standard normal distribution.

UNIT- II: STATISTICAL METHODS

Curve fitting by least squares method: Bi-variate data, scatter diagram, method of least squares, normal equations, fitting of straight line, second degree curve (parabola), exponential and power curves; Correlation: types of correlation, measures of correlation, Karl Pearson coefficient of correlation and its properties; Regression Analysis: Regression Coefficients and its Properties, Regression lines.

UNIT-III: SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS (LARGE SAMPLES)

Sampling distributions: population, sample, population parameters, sample statistic and types of sampling, sampling distribution of means (with and without replacement), standard error, Testing of hypothesis (large samples): Statistical hypothesis, null hypothesis, alternative hypothesis, type-I and type-II errors, critical region, level of significance, one tailed and two tailed tests.

Large Sample tests: Z-test for single mean and difference of means, single proportion and difference of proportions.

UNIT-IV: TESTING OF HYPOTHESIS (SMALL SAMPLES)

Testing of hypothesis (small samples): Introduction to small sample tests, degrees of freedom, Student's t, F and Chi-square distributions; student's t-test: t-test for single mean, difference of means and paired t-test; Chi-square test: Goodness of fit, independence of attributes, F-test: equality of population variances.

UNIT-V: QUEUING THEORY

Introduction to Queuing Models: Introduction to stochastic process, states space, Markovian's property, Input pattern, service pattern, queue discipline, Queue behavior, Kendal’s notation, Pure Birth and Death Models, Traffic intensity; (M/M/1: ∞/FIFO)-Model: Average System length, Average queue length , Average waiting time and related probabilities; (M/M/: N/FIFO)-Model: Average system length, average queue length, average waiting time and related probabilities.

TEXT BOOKS:

1. RE Walpole, SL Mayeres & K May, Probability and Statistics for Engineers & Scientists, 3/e, Pearson Publishers
2. T.K.V. Iyengar et al, Probability and Statistics, S. Chand Publications, Revised edition.

REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
2. Murugesan and Gurusamy, Probability, Statistics and Random Process, Anuradha Publicatons.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

COURSE OUTCOMES:

At the end of course, students shall be able to:

CO 1 Recall the concepts of random variables, probability distributions and statistical methods.

CO 2 Recall the concepts of Sampling distributions and testing of hypothesis (large samples).

CO 3 Recall the concepts of testing of hypothesis (small samples), stochastic processes and queuing models.

CO 4 Understand and interpret the concepts of random variables, probability distributions and statistical methods.

CO 5 Understand and interpret the concepts of Sampling distributions and testing of hypothesis (large samples).

CO 6 Understand and interpret the concepts of testing of hypothesis (small samples), stochastic processes and queuing models.

CO 7 Apply the tools of probability and statistics to real world problems.

CO/PO Mapping

Course Title:	MATHEMATICS-II (CSE & IT)													
Course Code:	A3MAT103													
Course Designed by	Dept. of Mathematics													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2							2			
CO2	3	3		2							2			
CO3	3	3		2							2			
CO4	3	3		2							2			
CO5	3	3		2							2			
CO6	3	3		2							2			
CO7	3	3		2							2			

Course designed by	DEPARTMENT OF MATHEMATICS
Approval	Approved by: Meeting of Board of Studies held on 06.07.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3CYT101	SEMESTER - II	L	T	P	C
	ENGINEERING CHEMISTRY (Common to all branches)	3	-	-	3
	Total Contact Hours – 48				

SYLLABUS

UNIT 1: WATER TECHNOLOGY

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

UNIT 2: POLYMERS

Introduction to polymers, functionality of monomers, addition and condensation polymerization, copolymerization, stereospecific polymerization with specific examples. Thermoplastics and Thermo-sets – their differences.

Elastomers – applications with specific examples- Preparation, properties and uses of PVC, Bakelite, Teflon and Nylon-6, 6, Buna-S and Thiokol rubber- Fibre reinforced plastics – carbon fibre, glass fibre and aramids.

UNIT 3: ELECTROCHEMISTRY AND APPLICATIONS

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells –dry cell- Secondary cells – lead acid, nickel-cadmium and lithium ion batteries- working of the batteries including cell reactions- Fuel cells, hydrogen-oxygen, and methanol fuel cells – working of the cells.

Corrosion: Introduction to corrosion, mechanism of dry and wet corrosion, Pilling Bedworth ratios and uses, Types of corrosion – Differential aeration corrosion, galvanic corrosion, pitting corrosion, waterline corrosion and stress corrosion, Factors affecting the rate of corrosion – metal based factors and environmental based factors, protection techniques – metal coatings – galvanization and tinning, cathodic protection, inhibitors – cathodic and anodic, organic coatings – paints – constituents and their functions.

UNIT-4: CHEMISTRY OF ADVANCED MATERIALS

NANOMATERIALS: introduction- synthesis of Nano material by sol gel method- CVD- engineering applications of Nano materials

CEMENT: Introduction to ordinary Portland cement- manufacturing of OPC- setting and hardening of cement- decay of cement.

FUELS: Introduction- classification- liquid fuels- cracking- knocking- octane number and cetane number; Lubricants- definition- mechanism and properties of lubricants

UNIT 5: INSTRUMENTAL METHODS AND APPLICATIONS

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle, instrumentation (Block diagram and working), applications of UV, IR and NMR spectroscopic methods. Chromatography- introduction- Ion exchange chromatography- applications

COURSE OUTCOMES:

CO1: The student will have the ability to describe softening methods and desalination processes. He/ She will be able to explain various types of polymers; preparation, properties and engineering applications of thermoplastic, thermosetting plastics, rubbers and FRP's.

CO2: The student will have the ability to describe electrochemical reactions, principles of batteries, fuel cell and corrosion.

CO3: The student will have the ability to outline electromagnetic spectrum and explain the working principles of IR, UV, NMR and chromatographic techniques. The student describes the synthesis, properties and applications of nanomaterials, cement. HE/ She Outlines the cracking methods, knocking of fuels.

CO4: The student will have the ability to differentiate between hard and soft water, demineralization and deionization processes and thermosetting – thermoplastic materials.

CO5: The students will have the ability to give examples on primary and secondary batteries, various types of corrosion, methods of corrosion prevention.

CO6: The student will have the ability to draw inferences on the principles and applications of various instrumental methods and also can compare and contrast between cracking methods.

CO7: The student will have the ability to analyze water samples and validate the results obtained and apply their knowledge on polymers, batteries, materials and instrumentation.

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Text books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

Reference books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. H.Kaur, Instrumental Methods of chemical analysis, Pragathi Prakashan, 2012.
3. Chemistry for Engineers, Teh Fu Yen, Imperial college press, London

CO/PO Mapping

Course Title:	Engineering Chemistry													
Course Code:	A3CYT101													
Course Designed by	Dept. of Chemistry													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2			1		
CO2	3								2			1		
CO3	3								2			1		
CO4	3								2			1		
CO5	3								2			1		
CO6	3								2			1		
CO7	3								2			1		

Course designed by	DEPARTMENT OF CHEMISTRY
Approval	Approved by: Meeting of Board of Studies held on 29.06.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3EET201	SEMESTER – II	L	T	P	C
	Basic Electrical Engineering (Common to all braches)	3	1	3	5
	Total Contact Hours – 50				

SYLLABUS

UNIT 1: D.C. CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, Analysis of simple circuits with DC excitation, Superposition, Thevenin's and Norton's Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT 2: A.C. CIRCUITS

Representation of sinusoidal waveforms, Average and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase AC circuits (Series & Parallel), Resonance, Three-phase balanced circuits, voltage and current relations in star and delta configurations.

UNIT 3: DC & AC MACHINES [ELEMENTARY TREATMENT ONLY]

Principle and operation of DC Generator - EMF equation – open circuit characteristic of DC shunt generator – principle and operation of DC Motor – Types of DC Motors – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of single-phase Transformer - OC and SC tests on transformer - principle and operation of single phase & Three phase Induction Motors, construction and working of synchronous motors

UNIT 4: BASICS OF POWER SYSTEMS:

Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary & Secondary distribution systems.

UNIT 5: ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Types of Batteries, Characteristics of Batteries. Elementary calculations for energy consumption, power factor improvement, battery backup.

TEXT BOOK/ REFERENCES:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. Vincent Del Toro, "Electrical Engineering Fundamentals", Pearson, 2015.

COURSE OUTCOMES:

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

CO1. To recall fundamental concepts of electrical circuits such as charge, voltage, current and power.
CO2. Describe the principle of operation of D.C. & A.C. machines.
CO3. Outline the working operation of various generating stations.
CO4. Explain the procedure for solving circuits with A.C and D.C. Excitation
CO5. Summarize the performance characteristics of different machines.
CO6. Explain about different equipment used in power industry
CO7. Apply the fundamental laws, associated with Basic Electrical Engineering to solve real world problems in the field of Engineering

CO/PO Mapping

CO / PO mapping	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
To recall fundamental concepts of electrical circuits such as charge, voltage, current and power.	3	3	1	1			3			1			1	1
Describe the principle of operation of D.C. & A.C. machines.	3	2	2	2	2					1			1	1
Outline the working operation of various generating stations.	3	3	3	1	1		1			1			1	1
Explain the procedure for solving circuits with A.C and D.C. Excitation	3	3	2	1	1		2			1			1	1
Summarize the performance characteristics of different machines.	3	3	2	1	1	3	1			1			1	1
Explain about different equipment used in power industry	3	3	2	1		2	2			1		1	3	2
Apply the fundamental laws, associated with Basic Electrical Engineering to solve real world problems in the field of Engineering	3	3	3	3	3	2	2			2		3	3	3

Course designed by	Department of Electrical & Electronics Engineering
Approval	Approved by: Meeting of Board of Studies held on 29.06.19
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3EHL001	SEMESTER - II	L	T	P	C
	Essential Communication in English	1	-	3	3
	Total Contact Hours – 60				

SYLLABUS

UNIT – I: BASIC LANGUAGE SKILLS – A REFRESHER

Organs of Speech: Consonant Sounds &Vowel Sounds; Phonemic Transcription; Using a Dictionary to know the Pronunciation of a word

Presenting Oneself: Introducing oneself -Using different expressions in Formal&Informal Contexts.

Reading a News Article: Identifying the key words and their usage; summarizing the information

Word Study & Mind Mapping: Root words–Derivatives; Homonyms, Homographs, Homophones; Synonyms & Antonyms

UNIT – II: RUDIMENTS OF FUNDAMENTAL COMMUNICATION

The World: Listening & watching Documentaries on World famous Places.

Describing People, Places and Life experiences: Physical Description- Describing someone's qualities – Usage of Jargon to present topography.

Short Story Corner: Reading a short story – Understanding the mood and essence – Sharing different perspectives.

Sentence Patterns: Concord – Rules – Common errors in day-day usage

UNIT-III: COMMUNICATION AT PRACTICE

Oratory Skills: Listening to World's Famous Speeches

JAM (Just a Minute) Talk: Format & Delivery Techniques

Nuances of Language: Company Description –Position Description (Formal) – processes like Chocolate Making(Informal)**.**

Types of Sentences – Declarative, Interrogative, Assertive etc.

UNIT-IV: COMMUNICATION THROUGH CONCEPTUAL LEARNING

BBC English: Watching interviews of Famous people.

Dialogue Practice: Situational Dialogues; Structuring a Role Play

New Inventions: Reading about latest technology pertaining to different fields (Source : Science Journals)

Transformation of sentences: Active Voice-Passive Voice**,** Direct & Indirect Speech**,** Degrees of Comparison**,** Simple Compound & Complex Sentences.

UNIT – V: COMMUNICATION THROUGH LIFE SKILLS

Watching Movies for Language Enrichment & Writing Reviews.

Skits: Enacting a Skit on a Social Issue

Reflections: Reading News Paper Editorial columns, Literacy Reviews, Poetry

Presenting an autobiography: Exploring different styles of writing autobiographies and evolving an own style**.**

TEXT BOOK:
Reference Source Compilation by the Department

REFERENCES:
1. **Fundamentals of Technical Communication** by Meenakshi Raman,OUP.
2. **Living English Structure** by W.Stannard Allen, Pearson Publications.
3. **English Made Easy** by Mary Margaret Hosler, Mc Graw Hill.
4.. **English and Communication Skills for Students of Science and Engineering**, by Dhanavel, S.P. Orient Blackswan Ltd.
5. **The Oxford Guide to Writing and Speaking** by John Seely , OUP

COURSE OUTCOMES:

CO1. Student will be able to come to terms with the basic language Skills required to cater to the requirement of the programme undertaken.

CO2. Student will be able to comprehend and analyze the core concepts well.

CO3. Student will be able to gain proficiency in all four skills of Language – Listening, Reading, Speaking and Writing.

CO4. Student will be able to understand the Syntactical and Grammatical Components of English Language and their correct use.

CO5: Student will be able to present his/her ideas confidently in a Professional manner.

CO/PO Mapping

Course Title:	**Essential Communication in English**													
Course Code:	A3EHL001													
Course Designed by	Dept. of English & Humanities													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2		2	3	3		3		
CO2						2		2	3	3		3		
CO3						2		2	3	3		3		
CO4						2		2	3	3		3		
CO5						2		2	3	3		3		

Course designed by	DEPARTMENT OF ENGLISH & HUMANITIES
Approval	Approved by: Meeting of Board of Studies held on 29.06.19
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

	SEMESTER - II	L	T	P	C
A3CYL101	**ENGINEERING CHEMISTRY LABORATORY (Common to all branches)**	**-**	**-**	**3**	**2**
	Total Contact Hours – 48				

List of Experiments:

1. Determination of HCl using sodium carbonate
2. Determination of Hardness of a groundwater sample.
3. pH metric titration of strong acid vs. strong base
4. Condcutometric titration of Strong acid VS Strong base
5. Condcutometric titration of Weak acid VS strong base
6. Potentiometric titration of Fe(II) with potassium dichromate
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of a polymer
9. Determination of viscosity of polymer solution using survismeter
10. Determination of percentage of Iron in Cement sample by colorimetry
11. Estimation of Calcium oxide in port land Cement
12. Preparation of Nanomaterials (ex: Fe/ Zn/ Ferrite)
13. Adsorption of acetic acid by charcoal
14. Determination of acid value and saponification value of a given lubricant
15. Project based learning (Mandatory for all students)

Course Outcomes:

CO1: The student will be able to determine total hardness, strength of acid in a lead acid battery, calcium in Portland cement using volumetric analysis

CO2: The student will be able to explain condcutometric, potentiometric, pH metric titrations and colorimetric determination.

CO3: The student will be able to explain the synthesis of a polymer, nanomaterials

CO/PO Mapping

Course Title:	Engineering Chemistry													
Course Code:	A3CYI101													
Course Designed by	Dept. of Chemistry													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1			1				1	1	2		
CO2	3		1			1				1	1	1		
CO3	3		1							1	1	1		

Course designed by	DEPARTMENT OF CHEMISTRY
Approval	Approved by: Meeting of Board of Studies held on 29.06.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3EEL201	SEMESTER – II	L	T	P	C
	Basic Electrical Engineering (Common to all braches)	3	1	3	5
	Total Contact Hours – 50				

LIST OF EXPERIMENTS

Basic safety precautions, Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope, resistors, capacitors and inductors.

1. Verification of Kirchhoff laws.
2. Verification of Network Theorems.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. Predetermination of performance parameters of 1 – Phase Transformer.
6. I – V Characteristics of Solar PV cell
7. Brake test on DC Shunt Motor.
8. Measurement of earth resistance.
9. Measurement of reactive power in three phase balanced circuit.
10. Measurement of Choke coil parameters
11. Brake test on 3 - Phase Induction Motor.
12. Determination of AC quantities using CRO/DSO.
13. I – V characteristics of battery.

COURSE OUTCOMES:

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

CO 1. Identify common electrical equipment used in laboratory.(L1)
CO 2. Estimate the ratings of different equipment used to perform an experiment. (L2)
CO 3. Demonstrate the usage of various electrical measuring instruments.(L3)
CO 4. Analyze the characteristics of rotating & stationery electrical machines (L4).
CO 5. Interpret the characteristics of PV cell and Battery.(L5)

CO/PO Mapping

CO / PO Mapping	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
Identify common electrical equipment used in laboratory.	3		1	1	3	1			3	2	2	2	2	1
Estimate the ratings of different equipment used to perform an experiment.	3	2	3	3	3	2	1		3	3	2	2	2	3
Demonstrate the usage of various electrical measuring instruments.	2	2	2	2	3	1			3	3	1	2	2	1
Analyze the characteristics of rotating & stationery electrical machines.	3	3	3	3	2				3	3		2	3	2
Interpret the characteristics of PV cell and Battery.	3	3	3	3	3		1		3	3	2	2	3	3

Course designed by	Department of Electrical & Electronics Engineering
Approval	Approved by: Meeting of Board of Studies held on 29.06.19
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.

A3CHW201	SEMESTER - II	L	T	P	C
	Work Shop (Chemical Engineering)	**0**	**0**	**3**	**2**
	Total Contact Hours – 45				

List of experiments

1. Distinguish between Laminar and turbulent flows – concept of Reynolds number
2. Use of manometers (different manometric fluids) to measure pressure drop – relate the pressure drop to fluid properties – express pressure in the height of a liquid (different) column – atmospheric pressure measurement
3. Measurement of fluid flow (liquids and gases) by different instruments
4. Determination of thermal conductivity of a metal rod.
5. Dissolution of solid in a liquid –identify the variables effecting the rate of dissolution
6. Diffusion of a solid in gas – factors effecting the rate – concepts of mass transfer
7. Estimation of half-life time (fractional life) of a chemical reaction (Hydrolysis of tertiary butyl chloride)
8. Estimation of chemical and physical parameters of ground and surface water like pH, TDS, conductivity.
9. Analysis of different oils to find acid value
10. Preparation of soap

Text book:

1. Unit Operations in Chemical Engg by W.L. McCabe and J.C. Smith and P Harriott, Mc Graw Hill 7th ed. 2005.
2. Mass Transfer Operations by R.E.Treybal, Mc. Graw Hill, 7th ed.

Reference books:

1. Brown G. G., "Unit Operations", CBS publishers.
2. Coulson J. H. and Richardson J.F., "Chemical Engg, Vol. I", 5th Ed., Butterworth-Heinemann.
3. Coulson J. H. and Richardson J.F., "Chemical Engg, Vol. II", 5th Ed., Butterworth-Heinemann.

Course Outcomes (CO)

Students will be able to

- Distinguish between laminar flow and turbulent flow based on Reynolds number.
- Determination of flow rates by U tube manometer.
- Determine the conversion of a chemical reaction.
- Characterize the solid particles.
- Estimate the chemical and physical parameters of ground and surface water such as pH, TDS, conductivity, hardness, turbidity and fluoride.
- Understand the magnitude of thermal conductivity
- Determination of solubility of solid in a liquid.

A3CHW201 Work Shop													
Course Outcomes	Program Outcomes												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	3	1							3	2		2	1	1
CO2	3	2							3	2		2	1	1
CO3	3	2							3	2		2	1	1
CO4	3	2							3	2		2	1	1
CO5	1	1							3	2		2	1	1
CO6	3	1							3	2		2	1	1
CO7	3	1							3	2		2	1	1

A3CHW201 Work Shop	
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on 29.06.2019.
	Ratified by: 5th Meeting of Academic Council held on 13.07.2019.

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A3CHT101	SEMESTER - III	L	T	P	C
	Biology for Engineers	**3**	**0**	**0**	**3**
	Total Contact Hours – 48				

SYLLABUS

UNIT-I:
Introduction: Biology and its applications, Biological classification, Living Organisms: Cells and Cell theory, Cell structure and function.

UNIT-II:
Biochemistry and molecular analysis: Chemical composition of living forms, analysis of Chemical composition, Carbohydrates, Amino acid and proteins, protein synthesis, Nucleic acids, lipids, nature of bonding and qualitative tests.

Unit-IIIA:
Genetics: Transfer of genetic information, Mendelian Law, Mendel's law of inheritance, Gene interaction, multiple allens, chromosome theory of inheritance., linkage, Recombination, Chromosome mapping, Genetic disorders, Nucleic acids, replication of DNA, types of RNA, Transcription, Genetic code, translation and steps in translation.

Unit-IIIB:
Metabolism: Thermodynamics as applied to biological systems. Exothermic and endothermic reactions. Concept of Keq and its relation to standard free energy, Spontaneity. ATP as an energy currency. The breakdown of glucose toCO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions, Concept of Energy charge.

UNIT-IV:
Enzymes and industrial applications: Mode of action of enzymes, properties of enzymes, chemical reactions, factors affecting enzyme activity, Co-factors, importance of enzymes, industrial application of enzymes.

UNIT-V:
Microbiology and Industrial applications: Microorganism, Growth kinetics, culture media, sterilization, Microscopy, application of microbiology, immunology and immunity, Cancer Biology, stem cells.

Course Outcomes:

Students will be able to:

1. Explain the importance of biology in engineering.
2. Identify the importance of chemicals like lipids, sugars, polysaccharides, amino acids and proteins
3. Know the importance of DNA and RNA
4. Describe the process metabolism
5. Know the various applications of industrial enzymes
6. Know the importance of industrial microbiology in the current scenario.
7. Explain importance of the microbes and its applications.

Text books:

1. Biology for Engineers by Wiley (ISBN: 9781121439931), 1st edition TMH, New Delhi (2019)
2. Suraish kumar G K, Biology for Engineers, Oxford University Press, New Delhi (2019)

References:

1. Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
2. Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)

Mapping of POs & COs (Program Outcomes & Course Outcomes)

A3CHT101 Biology for Engineers														
CO / PO mapping	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO-1	2			2				2	2		2	2	2	
CO-2	2												2	
CO-3	2												2	
CO-4	2												2	
CO-5	2												2	
CO-6	2			2				2	2		2	2	2	
CO-7	2												2	

A3CHT101 Biology for Engineers	
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on 29th Jun, 2019
	Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020

A3MAT105	SEMESTER - III	L	T	P	C
	MATHEMATICS-III (CHE)	3	0	-	3
	Total Contact Hours – 48				

Syllabus

Unit-I: Random Variables & Probability Distributions **09 Hours**

Random Variables: Discrete and continuous random variables, properties of mass and density functions. Mathematical Expectation: Properties (statements), Moment Generating Function; Outlines: of Binomial and Poission distributions; Normal Distribution: Probability density function, Normal approximation to Binomial Distribution, Parameters of Normal Distribution(statements), Characteristics of normal distribution, Area under normal curve, Standard normal distribution.

Unit-II: Statistical Methods **08 Hours**

Curve fitting by least squares method: Bi-variate data, scatter diagram, method of least squares, normal equations, fitting of straight line, second degree curve (parabola), exponential and power curves; Correlation: types of correlation, measures of correlation, Karl Pearson coefficient of correlation and its properties; Regression Analysis: Regression Coefficients and its Properties, Regression lines.

Unit-III: Sampling Distributions & Testing of hypothesis (Large Samples) 07+07 Hours

Sampling distributions: population, sample, population parameters, sample statistic and types of sampling, sampling distribution of means (with and without replacement), standard error, Testing of hypothesis (large samples): Statistical hypothesis, null hypothesis, alternative hypothesis, type-I and type-II errors, critical region, level of significance, one tailed and two tailed tests.
Testing of hypothesis (Large Samples): Large Sample tests: Z-test for single mean and difference of means, single proportion and difference of proportions.

Unit-IV: Testing of Hypothesis (Small Samples) **09 Hours**

Testing of hypothesis (small samples): Introduction to small sample tests, degrees of freedom, Student's t, F and Chi-square distributions; student's t-test: t-test for single mean, difference of means and paired t-test; Chi-square test: Goodness of fit, independence of attributes, F-test: equality of population variances.

Unit-V: Statistical Quality Control **08 Hours**

Concepts of quality control: Causes of variation of quality, Techniques of statistical quality control, process control and product control, control charts, methodology of constructing control charts, types of control charts; Control charts for variables: Mean chart (X- Chart), Range chart (R-chart) and standard deviation chart; Control charts for attributes: p-chart, np-chart and c-chart.

//Topics prefixed with ‘Outlines’ are not for assessment//

Text Books:

TB1 RE Walpole, SL Mayeres & K May, Probability and Statistics for Engineers & Scientists, 3/e, Pearson Publishers

TB2 T.K.V. Iyengar et al, Probability and Statistics, S. Chand Publications, Revised edition.

Reference Books:

RB1 MH Mahajan, Statistical Quality Control, Dhanpat Rai Publishers

RB2 Murugesan and Gurusamy, Probability, Statistics and Random Process, Anuradha Publicatons.

RB3 S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Course Outcomes

At the end of the course, students shall be able to:

CO 1	KO#1	Recall the concepts of random variables, probability distributions and statistical methods.
CO 2	KO#2	Recall the concepts of Sampling distributions and testing of hypothesis (large samples).
CO 3	KO#3	Recall the concepts of testing of hypothesis (small samples), stochastic processes and queuing models.
CO 4	UO#1	Understand and interpret the concepts of random variables, probability distributions and statistical methods.
CO 5	UO#2	Understand and interpret the concepts of Sampling distributions and testing of hypothesis (large samples).
CO 6	UO#3	Understand and interpret the concepts of testing of hypothesis (small samples), Statistical Quality Control
CO 7	AO#1	Apply the tools of Probability and statistics to real world problems.

CO/PO Mapping

Course Title:	Mathematics-III (CHE)
Course Code:	A3MAT105
Course Designed by	Dept. of Mathematics

CO	Program Outcome (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3		2							2			
2	3	3		2							2			
3	3	3		2							2			
4	3	3		2							2			
5	3	3		2							2			
6	3	3		2							2			
7	3	3		2							2			

Course Designed by	Dept. of Mathematics
Approval	Approved by Board of Studies (BoS) of Department of Mathematics in its 4th meeting held on 06.07.2019.
	Ratified by Academic Council in its 5th meeting held on 13.07.2019.

A3CHT202	**SEMESTER - III**	**L**	**T**	**P**	**C**
	Design Thinking and Product Innovation	3	0	0	3
	Total Contact Hours – 48				

SYLLABUS:

UNIT 1: Introduction to Design Thinking

Design Thinking in General : The Concept of Design Thinking, Wicked Problems, The Principles and the mindset of Design Thinking, Generic Phases of Design Thinking process and activities involved in each of the phase, Design Thinking Frameworks.

Design Thinking for New Product Development : Role of Design Thinking in NPD, When to Apply Design Thinking and When Not to, StageGate Vs Lean Vs. Agile methodologies Vs Design Thinking, Design innovation.

UNIT 2: Problem Identification process in Design Thinking

Empathize: Empathize - Goals and methods, Usage of Tools (Design Briefs - Nine Criteria with example), Usage of Tools (Creation of Personas, Illustrative application of Personas), Student Activity on Empathize phase.

Define: Importance of Define Phase, activities, Usage of Tools (Experience Mapping process with example), Usage of Tools (Developing Insights using HMW Questions, question ladder), Student Activity on Define phase.

UNIT 3: Problem Solving Process in Design Thinking, Case Study discussion & implementation

Ideate: Importance of Ideate Phase, 77 Design Heurisitics, Diverge Ideas, Converge Ideas Student Activity on Ideate phase

Prototype & Test*:* "A Design Thinking Product Development Framework", What Is a Story? What Is a Prototype?, "Putting It Together—Combining Stories and Prototypes", Employing Stories and Prototypes in Your Process

Case Study Implementation: Case Study Discussion mapping the End to End Design Thinking Process to the topics discussed till cluster 3**,** Case Study - 1 (Problem Identification Processes in Design Thinking)

Case Study - 1 (Problem Solving Processes in Design Thinking)

Case Study - 2 (Problem Identification Processes in Design Thinking) Case Study - 3 (Problem Solving Processes in Design Thinking) **Student implementing phases of DT towards Problem Solving:** Problem Area Identification

Application of Empathize Phase Application of Empathize Phase Case Study Evaluation Phase - 1

UNIT 4: Product Innovation

The Role of Design in Early-Stage Ventures: Introduction: An Emerging Start-up Culture, The Process: Winding from idea to product, Discussion on Case Study, Troubleshooting Common Mistakes

Optimal Design for Radically New Products: Introduction- six ideas and their implementation

Communicate the Challenge Goal toward Radically New Products, Shift Time Frames to Future and Past, Promote an Emerging Technology Focus across the Consumption Chain, Use of Analogical Thinking, Look for Novel Ways to Solve Simple Problems, Leverage More Ideators via Crowdsourcing

UNIT 5: Case Study implementation

Student implementing phases of DT towards Problem Identification & Solving

Application of Define Phase Application of Define Phase Case Study Evaluation Phase - 2

Application of Ideate Phase

Student implementing phases of DT towards Problem Identification & Solving

Application of Ideate Phase Build Prototype

Test the solution

Case Study Evaluation Phase – 3

Text books & Reference books:

1. Design think new product development essentials from the PDMA – Wiley edition
2. Product Design and Development Karl Ulrich (Author), Steven Eppinger –Fifth edition
3. Design Thinking Getting Started Sidneyeve Matrix, https://innovationbydesign.pressbooks.com/
4. https://en.wikipedia.org/wiki/Wicked_problem
5. https://web.mit.edu/jrankin/www/engin_as_lib_art/Design_thinking.pdf
6. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
7. https://www.interaction-design.org/literature/article/design-thinking-a-quick-overview
8. https://www.designorate.com/measuring-the-impact-of-design-thinking/
9. https://www.mindtheproduct.com/understanding-design-thinking-lean-agile-work-together/
10. https://www.sopheon.com/spiral-development-lean-vs-stage-gate/#:~:text=In%20practice%2C%20lean%20product%20development,is%20completed%20within%20each%20stage.
11. https://medium.com/codomo/what-is-design-innovation-why-you-need-to-know-it-b8d850503b3a
12. https://dschool-old.stanford.edu/groups/k12/wiki/3d994/empathy_map.html
13. https://www.designkit.org/methods/how-might-we
14. https://careerfoundry.com/en/blog/ux-design/what-is-ideation-in-design-thinking/
15. https://www.interaction-design.org/literature/article/stage-3-in-the-design-thinking-process-ideate

Course Outcomes:

Students will be able to:

1. Describe various phases of Design Thinking and various tools for Empathizing in Design Thinking
2. Describe various tools for Ideation, Prototyping in Design Thinking
3. Outline the Design process for new Product development in startups and techniques to design Radically New Products
4. Give examples for empathizing and defining phases in Design Thinking
5. Give examples for Ideation, Prototyping in Design Thinking
6. Draw inferences on designing radically new products in emerging startups.
7. Apply Design Thinking principles, methodologies, phases and tools to design a New/Radically new Process/Service/Product

CO/PO Mapping:

A3CHT202: Design Thinking and Product Innovation														
Course designed by	Department of Mechanical Engineering													
CO / PO mapping	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PS02
i.	3	1	1	1	1	1		1	1		1	1	2	2
ii.	3	1	1	1	1	1		1	1		1	1	2	2
iii.	3	1	1	1	1	1		1	1		1	1	2	2
iv.	3	3	3	2	2	1		1	2	1	1	2	2	2
v.	3	3	3	2	2	1		1	2	1	1	2	2	2
vi.	3	3	3	2	2	1		1	2	1	1	2	2	2
vii.	3	3	3	3	3	2	1	1	2	1	2	2	3	3

A3CHT202: Design Thinking and Product Innovation	
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on
	Ratified by: 2nd Meeting of Academic Council

A3CHT301	SEMESTER - III	L	T	P	C
	CHEMICAL TECHNOLOGY	3	0	0	3
	Total Contact Hours – 48				

SYLLABUS

UNIT-I

Basic principles of Unit process and Unit operations in Chemical Industries,

Chlor- Alkali Industries: Manufacturing of Soda ash by Solvay & Dual process, caustic soda and chlorine by Electrolytic process.

Glass Industries: manufacture of Glass by Fourcault & continuous sheet process, Properties & applications of special glasses

UNIT II

Fuel &Industrial gases: producer gas, water gas & Coke oven gas; Carbon dioxide

Cryogenics in Chemical Industries: Hydrogen, oxygen and Nitrogen Production

Nitrogen & Fertilizer industries: synthetic ammonia, urea, nitric acid, ammonium nitrate, ammonium phosphate and complex fertilizers.

UNIT-III

Part-A:

Sulphur Industries: Extraction of sulphur by Frasch process, manufacture of sulphuric acid by contact process.

Industrial Chemicals: Hydrochloric acid and Aluminum sulphate and miscellaneous salts

Part-B:

Cement Industries: Portland Cement manufacture, special cements, miscellaneous calcium compounds, magnesium compounds

UNIT-IV

Petrochemical & Polymer Industries: Manufacture of phenols, formaldehyde, vinyl chloride and, manufacture of phenol- formaldehyde resin and polyvinyl chloride polymer, SBR.

UNIT-V

Natural Product Industries: Oils- Definition, constitution, extraction and expression of vegetable oils, refining and hydrogenation

Soaps and Detergents: Definitions, continuous process for the production of fatty acids, glycerin and soap, production of detergents.

Pulp and paper industry: Methods of pulping, production of sulphate and sulphite Pulp, production of paper –wet process

TEXT BOOK:

1. Shreeve's Chemical Process Industries edited by Austin, McGraw-Hill.5th ed.1985.
2. Dryden's Outlines of Chemical Technology, edited by M.Gopal Rao and M.Sittig, 2nd ed. 1973.

REFERENCES:

1. Industrial Chemistry by B.K.Sharma
2. Hand book of Industrial Chemistry Vol 1&II K.H.Davis& F.S. Berner Edited by S.C. Bhatia, CBS publishers

3. Austin, G. T., Shreve's Chemical Process Industries, Tata – McGraw Hill Publishers, 2012.

COURSE OUTCOMES: A student will be able

1. To learn the concepts of unit operations and unit processes involved in chemical processes
2. To Have technological knowledge of various process equipment and their respective functionalities in Process flow sheet.
3. To relate the physical and chemical properties of various chemical compounds towards the working principles of various established technology in industrial flow sheets
4. To Learn the complexity of various process equipment such as heat and mass transfer units, etc.
5. To Have conceptual knowledge towards the application of principles of energy efficient, pollution abatement and raw material recovery and reuse in process flow sheets
6. To have an overall idea towards various alternate processes for the manufacture of important inorganic and organic products.
7. To Have a working knowledge towards various safety issues, engineering problems & economics etc., associated to both inorganic and organic chemical technology

A3CHT301 CHEMICAL TECHNOLOGY														
CO / PO mapping	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1	2				1							2
CO2	3	2	2	2	1						1	1		3
CO3	3	1	2	2	1						1	1		3
CO4	3	2	3	2	1		1				1			2
CO5	2	2	2	1	1		1				1			3
CO6	2	2	2	1	1		1				1		1	
CO7	2	2	2	3	1		1						1	2

A3CHT301 CHEMICAL TECHNOLOGY	
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on 29th Jun, 2019
	Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020

A3CHT302	SEMESTER - III	L	T	P	C
	FLUID MECHANICS FOR CHEMICAL ENGINEERS	3	0	0	3
	Total Contact Hours – 48				

SYLLABUS

UNIT-I:
Basics on dimensional Analysis, Nature of fluids, hydrostatic equilibrium, applications of fluid statics: U-Tube and Inclined Manometers.
Fluid flow phenomena- Rheological properties of fluids, Boundary layers.

UNIT-II
Basic equation of fluid flow –Mass balance in a flowing fluid; continuity,
Differential momentum balance; Equation of motion.

UNIT-III

Part -A

Incompressible Newtonian /Non Newtonian Flow in pipes and channels- shear stress and skin friction in pipes, laminar flow & turbulent flow in pipes and channels.

Part- B

Flow of compressible fluids- Definitions and basic equations, Processes of compressible flow Isentropic flow through nozzles, adiabatic frictional flow & isothermal frictional flow.

UNIT-IV:
Flow past immersed bodies, Drag and Drag coefficient, flow through beds of solids, Motion of particles through fluids.
Fluidization: Types of fluidization, Minimum fluidization velocity & applications of fluidization.

UNIT-V:
Transportation and Metering of fluids- Pipes, fittings and valves.
Pumps: positive displacement pumps, and centrifugal pumps, Fans, blowers, and compressors.

TEXT BOOK:

1. Unit Operations of Chemical Engineering by W.L.McCabe, J.C.Smith& Peter Harriot, McGraw-Hill, 6th Ed, 2001

REFERENCE BOOKS:

1. Transport processes and unit operations by Christie J. Geankoplis, PHI.
2. Introduction to Fluid mechanics by R.W. Fox, A.T.McDonald, P.J.Pritchard, JohnWiley and sons-6th edition

COURSE OUTCOMES:

Student will be able to

I. Analyze fluid flow in circular and non-circular conduits.
II. Do calculations involving Bernoulli's equation for transport of fluids in pipelines.
III. Calculate pressure drops and energy requirements associated to fluid flow in pipes.
IV. Calculate the pressure drops and energy requirements associated to compressible fluid flow in circular and rectangular ducts.
V. Estimate pressure drop in packed bed and fluidized bed
VI. Carry out various calculations associated to fluid flow in various types of pumps.
VII. Calculate and calibrate various flow measuring devices.

A3CHT302 FLUID MECHANICS FOR CHEMICAL ENGINEERS														
Course designed by	Department of Chemical Engineering													
CO / PO mapping	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		2	2							2	2	2
CO2	3	3		2	2							2	2	2
CO3	3	2		2	2							2	2	3
CO4	3	2		2	2							2	2	3
CO5	3	3		2	2							2	2	3
CO6	3	2		2	2							2	2	3
CO7	3	1		2	2							2	2	3

A3CHT302	**FLUID MECHANICS FOR CHEMICAL ENGINEERS**
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on 29th Jun, 2019
	Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020

A3CHT201	SEMESTER - III	L	T	P	C
	AI Tools, Techniques and Applications	**3**	**0**	**3**	**5**
	Total Contact Hours : 96				
	Prerequisites: PPS Course				

SYLLABUS

UNIT-I: Introduction to Python

The basic elements of python, Control Structures, Loops, Functions and scoping, Recursion, Global variables, Modules, Strings, Files.

UNIT-II: OOP in Python

Structured Types, Mutability and Higher-Order Functions, Tuples, Lists and Dictionaries, OOP in Python: Classes, Objects, Constructors, Inheritance, Encapsulation.

UNIT-III: Introduction to AI

Basics of AI. Applications of AI. Advanced search, Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning

Conceptual introduction to **Machine Learning:** Introduction to Neural Networks, Supervised, Unsupervised, and Semi-Supervised Learning, introduction to Reinforcement learning, Deep Learning: layers, activation functions, optimizers.

UNIT-IV: Image Processing

Conceptual introduction to **Image Processing & Computer Vision:** Introduction to Image processing, Setting up OpenCV, Filtering Images, Tracking Faces with Haar Cascades, Detecting Edges and Applying Image Filters, Detecting and Tracking Different Body Parts, Extracting Features from an Image.

Applications: ***GEN*****:** Automation, Agriculture [Crop and Soil Monitoring, Grading farm produce, Predictive Analytics]. ***CHEM:*** Industrial Reactors.

Unit V: Computer Vision:

Image - Definition and Tagging. Classification of images. Image formation, Deep Learning algorithms for Object detection & Recognition. Object Tracking, Stereo Vision and 3D Reconstruction, Augmented Reality

Applications: ***GEN*****:** Robotics; ***CHEM***: Industrial systems.

Text Books:

- Programming and Problem solving with PYTHON, McGraw Hill Education, Ashok Namdev Kamthane, Amit Ashok Kamthane, 2018 (UNIT-I & II)
- Joseph Howse, Prateek Joshi, Michael Beyeler - OpenCV Computer Vision Projects with Python-Packt Publishing (2016) – (UNIT-IV & V)
- Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach (UNIT-III)

References:

- Tom Mickiewicz & Josh Zheng, Getting started with Artificial Intelligence, Published by O'Reilly Media, 2017.
- Aurelian Geron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017.
- Navin Kumar Manaswi, Deep Learning with Applications Using Python, Apress.

A3CHL301	SEMESTER - III	L	T	P	C
	FLUID MECHANICS LAB	0	0	3	1.5
	Total Contact Hours – 45				

COURSE OBJECTIVES	
	The students will be able
1	To provide practical knowledge in verification of principles of fluid flow
2	Understand the basic measurement techniques of fluid mechanics
3	To understand Major and Minor Losses
4	To gain knowledge in performance of pumps
5	To calculate pressure drop in packed, fluidized beds and helical coils
6	To calibrate V notch and Rotameter
7	To write clear lab reports

LIST OF EXPERIMENTS:

1. Verification of Bernoulli's Equation
2. Determination of discharge coefficient for orifice meter and its variation with Reynolds number
3. Determination of discharge coefficient for Venturi meter and its variation with Reynolds number
4. Determination of weir meter constant K for V-Notch
5. Determination of friction factor for flow through straight pipes of different diameters and study of variation of friction factor with Reynolds number
6. Determination friction losses in pipe fittings
7. Determination of characteristic curves for centrifugal pump.
8. Determination of characteristic curves for Reciprocating pump.
9. Determination of pressure drop of fluid flowing through helical coils
10. Determination of friction factor for packed beds.
11. Determination of variation of pressure drop with velocity in fluidized bed and hence find minimum fluidization velocity
12. Determination of variation of pressure drop with velocity of fluid flowing through helical coils
13. Calibration of Rota meter
14. Determination of critical velocity by Reynolds experiments
15. Determine the viscosity of glycerin using Stoke's Law and the concept of terminal velocity.

COURSE OUTCOMES:

After completion of the course, students will be able to do the following:

1. Measure pressure, discharge and velocity of fluid flow.
2. Collect, analyze data data and interpret the results and compare with values available in literature.
3. Calculate various types of energy losses in pipes and pipe fittings.
4. Determine viscosity of liquids using Stokes law
5. Measure Pressure drops with varying velocity through fluidized bed, Fixed bed and compare with values from theoretical equations.
6. To understand the performance of the pumps through characteristics pumps.
7. Work in teams and develop writing skill for report writing

A3CHL302 FLUID MECHANICS LAB													
Course designed by Department of Chemical Engineering													
CO / PO mapping	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											2	
CO2	3	3											2	
CO3	3			3									2	3
CO4	3			3									2	3
CO5	3			3									2	3
CO6									3					
CO7										3				

	A3CHL302 FLUID MECHANICS LAB
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on 29th Jun, 2019
	Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020

	SEMESTER - III	L	T	P	C
A3CHL302	**CHEMCAD LAB**	0	0	3	1.5
	Total Contact Hours – 48				

LIST OF EXPERIMENTS

1. Drawing of Flow Sheet Symbols – Equipments
2. Drawing of Flow Sheet Symbols – Valves
3. Drawing of Flow Sheet Symbols – Piping Lines
4. Drawing of Instrumentation Symbols
5. Drawing of Instrumentation Diagram
6. Drawing of Double Pipe Heat Exchanger
7. Drawing of Shell and Tube Heat Exchanger
8. Drawing of Evaporator
9. Drawing of Distillation Column
10. Drawing of Batch Reactor
11. Developing a new P&ID as per the given problem statement
12. Drawing of Spherical storage tank
13. Drawing of Any Manufacturing Process Flow sheet of an Industrial Chemical such as Caustic Soda, Soda Ash, Sulfuric Acid, Nitric Acid, Urea, Ammonia, Cement, Phenol, Paper Etc. (Project Based Learning Experiment)

TEXT/REFERENCE BOOKS

Joshi's Process Equipment Design by V.V.Mahajani, S.B.Umarji, 4th Edition, Macmillan Publishers, 2009.

Dryden's Outlines of Chemical Technology, edited by Gopal Rao, M and Marshall Sitting, , 3rd edition, East West Press, 2010.

COURSE OUTCOMES:

Student will be able to

1. Draw standard symbols used to represent various pipes, valves and fittings and their use in development of P&ID(Piping &Instrument Diagram) using AutoCAD.
2. Draw standard symbol used to represent various instruments, sensing elements, impulse lines, local& digital(DCS) instruments, pneumatic/electronic signals, controllers, control valves, etc. using AutoCAD.
3. Draw standard symbols used to represent process equipment using AutoCAD.
4. Draw Piping&Instrumentation Diagrams using AutoCAD
5. Draw Important Heat and Mass Transfer Equipments drawings using AutoCAD.
6. Prepare drawings of Storage Equipment using AutoCAD
7. Prepare Process flow sheet drawing of manufacturing process of any industrial chemical using AutoCAD

		PO													
		1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO	CO1			3		3		1						3	2
	CO2			3		3		1						3	2
	CO3			3		3		1						3	2
	CO4			3		3		1						3	2
	CO5			3		3		1						3	2
	CO6			3		3		1						3	2
	CO7			3		3		1						3	2

A3CHL302	**CHEMCAD Lab**
Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on 29th Jun, 2019
	Ratified by: 2nd Meeting of Academic Council, 13th AUG, 2020

A3CHL201	SEMESTER – III	L	T	P	C
	AI TOOLS, TECHNIQUES AND APPLICATION LABORATORY	-	-	3	2
	Total Contact Hours – 30				

Laboratory Experiments

Week 1) Working of operators, expression evaluation, ways of accepting input and displaying output. Recall the basics of elements of Python and their usage in different advanced packages.

Week 2 & 3) Explore on control and iterative statements.

Week 4 & 5) Working on Functions, Strings, Files, and Global variables along with modules.

Week 6 &7) Explore on python data Structures like lists, tuples and dictionaries.

Week 8) Integrating Machine Learning with Computer Vision.

Week 9) Image preprocessing operations using openCV

Week 10) Feature extraction of an image

Week 11) Perform object detection.

Week 12) Image classification

Week 13) Lab based Project

Week 14) Lab based Project

References:

1. Programming and Problem solving with PYTHON, McGraw Hill Education, Ashok Namdev Kamthane, Amit Ashok Kamthane, 2018.
2. AI Tool and Techniques Laboratory manual.
3. Computer Vision with Python 3, Packt Publishing Ltd, Saurabh Kapur, 2017.

Course Outcomes:

After completing this course, the students will:

1	Have the ability to describe basic programming constructs and object oriented programming concepts in Python
2	Have the ability to describe the fundamentals of AI & ML concepts and DL concepts.
3	Have the ability to describe about Image Processing & Computer Vision concepts
4	Have the ability to explain the fundamental concepts and OOP of Python.
5	Have the ability to explain and outline the features of AI & ML and DL
6	Have the ability to demonstrate the Image Processing techniques & Computer Vision concepts and apply in various domains.
7	Have the ability to apply the concepts of Python and solve AI problems through programming with Python.

A3CHL201 & AI Tools, Techniques and Applications														
Course designed by			Department of Electronics and Communication Engineering											
CO / PO mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			3						2	3		
CO2	3	2	2	1									3	
CO3	3	2	2	1									1	
CO4	2	1			3							1		
CO5	3	2	2	1									2	
CO6	3	2	2	1									2	
CO7	3	2	2	1							1	2	3	

1. Low 2. Medium 3. High

A3CHL201 & AI Tools, Techniques and Applications

Course designed by	Department of Chemical Engineering
Approval	Approved by: Meeting of Board of Studies held on
	Ratified by: Meeting of Academic Council

A3EHA702	**SEMESTER – III**	**L**	**T**	**P**	**C**
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	**2**	**-**	**-**	**0**
	Total Contact Hours – 30				

BROAD OBJECTIVE

Make students understand the thought process, reasoning and holistic life style of Yogic system.

Course Objectives:

- To impart basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.

- To impart holistic lifestyle of Yogic-science and wisdom capsules in Sanskrit literature which is very important in modern society experiencing rapid technological advancements and societal disruptions.

- To focus on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

Course Content

- Basic Structure of Indian Knowledge System

  i) Ashtadasa vidya
  ii) Veda
  iii) Upavedha
  iv) Ayurvedha
  v) Dhanurvedha
  vi) Ghaandravedha
  vii) Vedang
    a. Shiksha,Kalp
    b. Nirutha
    c. Vyakaran
    d. Jyotishya)
  viii) Shastra
    a. Meemamsha
    b. Purana
    c. Tarka Shasthra

- Modern Science and Indian Knowledge System

- Yoga and Holistic Health care

- Case Studies.

Suggested Text/Reference Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
9. P R Sharma (English translation), Shodashang Hridayam

COURSE OUTCOMES

CO -1: The students will be able to comprehend the concepts of Indian Traditional Knowledge.
CO-2: The Students will be able to connect themselves with Knowledge from the modern scientific perspective.
CO-3: The students will be able to connect the past with the present advancements in Technology.
CO-4: The students will be to come to terms with the holistic health care system.
C0-5: The students will be able to develop critical thinking skills.
C0-6: The students will be able to comprehend the principles enshrined in ancient Sanskrit Literature

CO/PO Mapping

Course Title:	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1						**2**								
CO2						**2**								
CO3						**2**								
CO4						**2**								
CO5						**2**								
C06						**2**								

Course designed by	DEPARTMENT OF ENGLISH & HUMANITIES
Approval	Approved by: Meeting of Board of Studies held on 23.06.2019
	Ratified by: 5th Meeting of Academic Council, 13-07-2019.