FOREWORD

The Department of Chemical Engineering has revised the structure and syllabi of B. Tech. (Chemical Engineering) w.e.f. 2010-11. In the present structure the total number of credits required for graduation are 200 which includes courses in humanities, basic sciences, courses from other departments and core and elective courses from Chemical Engineering Department. The detailed structure along with syllabi and faculty profiles will give complete picture at a glance to incoming entrants.

The syllabi have been revised and updated to create awareness among students about the new developments in the field of engineering and technology. New equipment have been added in the department and new experiments are now part of the curriculum. This will help the students to cope with the developments taking place in the field of chemical engineering.

I appreciate all those who have contributed in bringing this good, constructive and useful endeavor.

(Prof. Sattar Husain)

Chairman
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## LIST OF CHAIRMEN

<table>
<thead>
<tr>
<th>Name</th>
<th>From</th>
<th>To</th>
</tr>
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<tbody>
<tr>
<td>Prof. S. S. ALAM</td>
<td>10-12-1981</td>
<td>09-12-1986</td>
</tr>
<tr>
<td>Prof. SHAUKAT ALI</td>
<td>10-12-1986</td>
<td>16-02-1989</td>
</tr>
<tr>
<td>Prof. S. S. ALAM</td>
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<td>16-02-1992</td>
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<tr>
<td>Prof. SHAUKAT ALI</td>
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<td>21-02-1994</td>
</tr>
<tr>
<td>Prof. S. S. ALAM</td>
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<td>Prof. SHAUKAT ALI</td>
<td>22-02-1997</td>
<td>21-02-2000</td>
</tr>
<tr>
<td>Prof. MOHAMMAD IDREES</td>
<td>22-02-2000</td>
<td>02-03-2003</td>
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<tr>
<td>Prof. SHAUKAT ALI</td>
<td>03-03-2003</td>
<td>11-12-2005</td>
</tr>
<tr>
<td>Prof. MOHAMMAD IDREES</td>
<td>12-12-2005</td>
<td>11-12-2008</td>
</tr>
<tr>
<td>Dr. SATTAR HUSAIN</td>
<td>12-12-2008</td>
<td>08-06-2009</td>
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<td>Prof. MOHAMMAD IDREES</td>
<td>09-06-2009</td>
<td>08-06-2012</td>
</tr>
<tr>
<td>Prof. SATTAR HUSAIN</td>
<td>09-06-2012</td>
<td>Present</td>
</tr>
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</table>
ABOUT THE DEPARTMENT

The idea of the creation of the Department of Chemical Engineering at AMU was born with the visit of his Highness Sheikh Zaid Bin Sultan Al-Nahant of the UAE in 1975. The approval of the UGC was obtained for the creation of the Department in the fifth Five Year Plan and it came into existence in 1978, when the first undergraduate course in Chemical Engineering started with an intake of thirty students.

A Post-graduate Diploma in Petroleum Processing was started in the Department in 1987, which was upgraded to full-fledged degree, M.Sc. Engg. (Petroleum Processing) in 1988. Subsequently, a masters programme, M. Tech. (Chemical Engineering) was started in 1999 with specialization in Process Modelling and Simulation. Another specialization, "Computer Aided Design of Process Plant" has also been approved.

Apart from B. Tech. and M. Tech. programmes, the Department also offers PhD in Chemical Engineering in a wide range of thrust areas: heat transfer, waste management, nanotechnology, mass transfer, enhanced distillation thermodynamics, and modelling & simulation etc. Till date five PhDs have been awarded while four are in progress.

Thrust Area/ Core Competence of the Department:

i. Heat Transfer (Thermo-siphon Reboiler, Pool Boiling and it's Enhancement)
ii. Fluid Mechanics and CFD
iii. Computer Aided Design and Thermodynamics
iv. Membrane Separation
v. Process /Mathematical Modelling and Simulation
vi. Nanomaterial and Nano composites
vii. Industrial Pollution Control, Solid/Hazardous Waste Management
viii. Waste Minimization
ix. Artificial Neural Network etc.
VISION AND MISSION OF DEPARTMENT

VISION

To be a world class Chemical Engineering Department that imparts high quality education to its graduates and prepares them to be leaders in chemical engineering and allied fields.

MISSION

1. To produce globally acceptable, competent, ethically strong and professional chemical engineers to serve the needs of society as engineers, technocrats, entrepreneurs and leaders.
2. To foster process engineering knowledge through collaborative research and innovation with leading academic institutions and industry.
3. To prepare the students coming from different socio-economic levels including a sizeable number from the marginalized sections of society for a successful career in chemical engineering and allied fields.
4. To create a conducive environment to attract and retain the best faculty.

Programme Educational Objectives (PEOs)

PEO1. To provide necessary background in science, particularly in advanced mathematics, physics and chemistry that underline modern chemical engineering and technology.

PEO2. To provide training so that the graduates are able to choose their careers as practicing chemical engineers in traditional chemical industries as well as in expanding areas of material, environment and energy related industries and be able to solve problems relevant to the general practice of chemical engineering and engineering design.

PEO3. To prepare students so that they function effectively in the complex modern work environment with the ability not only to work as part of a team but also to assume professional leadership roles.

PEO4. To promote awareness among students for life-long learning and noble human values, and to inculcate in them professional ethics and codes of practice.

PEO5. To motivate the students to engage in post-baccalaureate study and make timely progress toward and advanced degree in chemical engineering or a related business.
Programme Outcomes:

a. The Chemical Engineering Graduates are able to apply knowledge of mathematics, science, and Engineering.

b. The Chemical Engineering Graduates are capable to design and conduct experiments, as well as to analyze and interpret data.

c. The Chemical Engineering Graduates are capable to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. The Chemical Engineering Graduates are capable to function on multidisciplinary teams.

e. The Chemical Engineering Graduates are capable to identify, formulate, and solve engineering problems.

f. The Chemical Engineering Graduates have the understanding of professional and ethical responsibility.

g. The Chemical Engineering Graduates are able to communicate effectively.

h. The Chemical Engineering Graduates have a broad education necessary to understand the impact of engineering solutions in a global, economic environmental, and societal context.

i. The Chemical Engineering Graduates have recognition of the need for, and an ability to engage in life-long learning.

j. The Chemical Engineering Graduates have knowledge of contemporary issues.

k. The Chemical Engineering Graduates are capable to use the techniques, skills, and modern engineering tools necessary for engineering practice.

l. The Chemical Engineering Graduates are capable to apply fundamental and practical knowledge of unit operations and processes, principle of management and economics for providing better services to chemical process and allied industries.
FACULTY PROFILE
Dr. MOHAMMAD IDREES
Designation: Professor
E-mail: idreesingenieur@gmail.com
Date of Joining AMU: April 01, 1982
☎: +91 – 571- 2700920/21 (Ext. 3157)
Address: QUBA, 374, Street No. 5
          Iqra Colony, New Sir Syed Nagar
          Civil Lines, ALIGARH 202002 UP

PROFILE:
Dr. M. Idrees obtained his B.S. (Chemical Engineering) from Harcourt Butler
Technological Institute, Kanpur. He Subsequently Joined Indian Institute of
Technology Kanpur and received his M.Tech. and Ph.D. degrees.
My teaching experience spans over more than three decades including those at IIT
Kanpur (as SRA & TA) and five years at Universiti Teknologi Malaysia, Kuala
Lumpur and Johor Bahru. I have been teaching core and advanced subjects both at
undergraduate and graduate level. Membrane Separations, Chemical Reaction
Engineering, Industrial Pollution Abatement and Hazardous Waste Management,
Simulation and Optimization, and Mass Transfer Operations are subjects of my
interest.
I had started my research career in the modeling and optimization of kraft pulping
which comprised both experimental work and mathematical modeling. Current
activities of my research group focus on hazardous waste management,
nanocomposite synthesis, mathematical modeling and simulation, reaction
engineering and process integration. We synthesized macromolecules and applied
the same for the removal of heavy metals from electroplating wastewater. A major
research project entitled ‘Environmental friendly management of hazardous
electroplating waste: A zero discharge plan’ is in progress. Another ongoing project
pertains to ‘Designing of N-Heterocyclic Carbene Based MOFs: Application in Gas
storage, Separation and in Catalysis’.
Our work have been published in journals like Pulp & Paper, Journal of Thermal
Analysis, Malaysian Oil Science and Technology, Chemical Engineering Research
and Design, Acta Crystallographica, International Journal of Advances in
Engineering Sciences, Iran Journal of Chemical Engineering, etc.
Dr. SATTAH HUSAIN
Email : drsattarhusain@yahoo.co.in
Designation: Professor
Date of Joining: March 1982
Phone: +91 – 571- 2700920/21 (Ext. 3159)
Address: Near Masjid Hajra, Dilshad Colony, Dhorra Mafi, Aligarh

PROFILE
I joined the department in March 1982 and actively participated in the growth of the department. Proceeded to U.O.R.(now I.I.T. Roorkee) to pursue Ph.D. Professor from June 2001, during last 32 years of teaching & research, travelled widely in India and abroad. in (36) International/ National Conferences /Seminars /Workshops /Courses etc. and guided many M. Tech. and Ph.D. and published 30 papers in International/ National Journals and Conferences like Int. Journal of Food Science and technology, Int. J. Chemical Sciences, Current World Environment, Environmental Pollution Control Journal, Material Science Research India, Beverage and Food World. The research areas of interest include Heat Transfer, Bioprocess/Food process engineering, and Environmental engineering. A life member of Indian Institute of Chemical Engineering, Kolkata (LM 22124) delivered invited lectures at NSIC Aligarh and UGC Sponsored programs at Academic Staff College of A.M.U. Examiner to some Universities and one Public Service Commission. He has also served as member of interview board of UPSC. He has been an expert member of chemical engineering in a team of UGC for assessment of autonomy of some Institutions in Assam & Jharkhand. He has also been actively engaged in many University level administrative/examination related activities for some years.

MR. NASEEM AHMAD KHAN
Email: nakhan63@rediffmail.com
Designation: Associate Professor
Date of Joining: September 2 1986
Phone: +91 – 571- 2700920/21 (Ext. 3163)
Address: 4/146-a Shibli Bagh, in front of Zakir Husain hostel, Jamalpur , Aligarh, UP, 202002

PROFILE
Mr. Naseem Ahmad Khan has done his M.Tech from Aligarh Muslim University and his research areas of interest include Heat Transfer, Modeling and Simulation and CAD. Many projects and Dissertation have been guided at UG level and PG level. Presently he is a TEQIP-II Project coordinator of Zakir Husain college of Engineering and Technology, AMU, Aligarh.
MR. M. ABDUL HAKEEM
Email: mahakim@rediffmail.com
Designation: Associate Professor
Date of Joining: 19.11.1988
☎: +91 – 571- 2700920/21 (Ext. 3160)
Address: 4/142-b shibli bagh, in front of zakir husain hostel(behind nabi nagar), badam nagar, Jamalpur , Aligarh, UP, 202002

PROFILE
Mr. Abdul Hakeem has received his postgraduate degree in 1988 from Banaras Hindu University. He joined as a Lecturer in the Department of Chemical Engineering in the November 1988, then promoted to lecturer selection grade from November 1998, afterwards placed as Associate professor from January 1st 2006. Major research areas include Heat Transfer, Thermosiphon Reboiler, Modeling and Simulation and soft computing. Paper in these areas had been published in the best international Journal of Chemical Engineering say AIChE, Aplied Thermal Engineering and Chemical Engineering Research and Design.

Dr. SADAF ZAIDI
Email: ss.zaidi.ke@amu.ac.in
Designation: Associate Professor
Date of Joining: 19.11.1988
☎: +91 – 571- 2700920/21 (Ext. 3167)
Address: H. No 4/875, Opposite City Montessori School, Friends colony, Aligarh-202002 (U.P.)

PROFILE
Dr. Sadaf Zaidi has obtained his Ph.D degree from Aligarh Muslim University. He joined the Department of Chemical Engineering, Aligarh Muslim University as a lecturer in November 1988. His research interests area are in the fields of soft computing, more specifically in data-driven modeling, boiling heat transfer (thermosiphon reboilers), petroleum processing and energy technology, renewable energy, food processing and solid waste management. He is a regular visitor to academic events like conferences, symposia, short term courses, workshops, etc. Some of the journals in which his articles have been published include Chemical Engineering Science, Chemical Engineering Research and Design (Elsevier), Chemical Engineering World, Chemical Products Finder, and Beverage and Food World. He is also actively engaged in the corporate activities on the campus.
Dr. SYED AKHLAQ AHMAD
Email : sa.ahmad.ke@amu.ac.in
Designation: Associate Professor
Date of Joining: December 1988
☎: +91 – 571- 2700920/21 (Ext. 3161)
Address: 4/1175 R-12, Syed Colony,
New Sir Syed Nagar, Aligarh 202001

PROFILE
Dr. Syed Akhlaq Ahmad has obtained his B.E in Chemical Engineering from University of Roorkee and Master of Technology and Doctor of Philosophy from Indian Institute of Technology Kanpur. He has joined the Department of Chemical Engineering, Aligarh Muslim University, Aligarh as Lecturer in December 1988. His major areas of research interests include Transfer Operations, Separation Processes, Modeling Simulation and Optimization, Thermodynamics of Phase Equilibria. He attended many national and international conferences. He published the research papers in reputed international journals like Korean Journal of Chemical Engineering, Fluid Phase Equilibria and International Journal of Scientific and Engineering Research.

Dr. JUNAID KHALIL
Email : mohdjunaiddkhalil@gmail.com
Designation: Associate Professor
Date of Joining: 18th September, 1989
☎: +91 – 571- 2700920/21 (Ext. 3162)
Address: Dr. Mohd Junaid Khalil Bait un Noor Sir Syed Nagar Aligarh, Pin code:
202002 UP, India

PROFILE
Dr. Mohd Junaid Khalil did his B.Tech from ZHCET in 1987, M.E. from UOR(now IIT Roorkee) in 1989 then subsequently joined the Deptt. Of Chemical Engineering at AMU as lecturer. In 2004 he acquired his Ph.D degree from IIT, Delhi. He has to his credit of around 20 papers which he has presented and published in various national and international conferences/journals of repute. He has taught quite many courses of chemical engineering at graduate and post graduate level ranging from basic to advance one. His area of research are Environmental Engineering, Modeling and Simulation, Chemical and Biochemical Engineering. He has also been contributing to campus life through various administrative, cultural and sports responsibilities.
Dr. SHEEBA JILANI
Email: sheeba_jilani@yahoo.co.in
Designation: Associate Professor
Date of Joining: 
☎️: +91 – 571- 2700920/21 (Ext. 3164)
Address: 4/1230 Sir Syed Nagar Aligarh 202002

PROFILE
Dr. Sheeba Jilani has obtained her Ph.D degree from I.I.T Roorkee in 2010. Her research areas include modeling of chemical engineering systems, separation processes, waste to energy conversion, and environmental pollution abatement. Some of the journals in which her articles are published include International/National Journals/Proceedings.

Dr. MOHAMMAD DANISH
Email: mohddanish.chem@zhcet.ac.in
Designation: Associate Professor
Date of Joining: 09-10-2000
☎️: +91 – 571- 2700920/21 (Ext. 3168)
Address: Dr. M. Danish, Flat No.: S-1, Azeem Residency, New Sir Syed Nagar, Aligarh

PROFILE
Dr. Mohammad Danish has obtained his Bachelor's Degree (B. Tech. in Chemical Engineering) from AMU, Aligarh in 1999. He has obtained his Master's and PhD degrees in Chemical Engineering from IIT Roorkee in 2002 and 2012, respectively. Dr. Danish joined AMU in 2000 as lecturer and at present he is working as Associate Professor in the Department of Chemical Engineering, A.M.U., Aligarh.

His research areas include Process Modelling & Simulation, Mathematical Methods, Transport Phenomena and Reaction Engineering. He has several publications in various reputed national and international journals. He has guided several M. Tech. dissertations in the area of modelling & simulation of chemical engineering systems. Currently he is supervising two PhD theses in the area of data driven modelling and waste water minimization. He is also actively engaged in administrative activities as well.
MRS. AISHATUL BUSHRA
Email: a.bushra@rediffmail.com
Designation: Assistant Professor
Date of Joining: 17th July 1998
☎: +91 – 571- 2700920/21 (Ext. 3166)
Address: SIDRAH, 4-389, Noor Bagh, Dodpur, Aligarh-202001

PROFILE
Mrs. Aishatul Bushra did her B.Sc Engg. from A.M.U. and M.E. Chemical Engg. (Computer Aided Process Plant Design) from UOR(now I.I.T Roorkee). Working as an Assistant Professor in the Department of Chemical Engineering, A.M.U, Aligarh since 17th July 1998 (approximately 14 years of teaching experience). Her research interest include Mass Transfer, Mixing, Process Modelling and Simulation and Transport Phenomenon.

MR. RAUNAQ HASIB
Email: rhasib@gmail.com
Designation: Assistant Professor
Date of Joining: May, 2009
☎: +91 – 571- 2700920/21 (Ext. 3165)
Address: 4/25, Firdaus Nagar, Aligarh – 202002

PROFILE
Mr. Raunaq Hasib has obtained B.Tech. in Chemical Engineering from AMU Aligarh and M.Tech. in Chemical Engineering from IIT Roorkee. Prior to joining AMU Aligarh he has served at Chemical Engineering Department, JIET Guna. He has also worked as guest researcher at Universität Stuttgart. Since 2009, he is serving AMU Aligarh as Assistant Professor.
His research interest includes Process Modelling, Simulation & Control, Computational Fluid Dynamics, and Multiphase Contactors. He has eight research papers in journals and conferences, and has guided several M.Tech. dissertations in the area of Computational Fluid Dynamics and Process Modelling & Simulation.
# SUPPORTING STAFF

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Employee</th>
<th>Designation</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Masood Alam</td>
<td>Personal Assistant</td>
<td>B.A., D.S.T.</td>
</tr>
<tr>
<td>4.</td>
<td>Wasi Ahmad</td>
<td>Semi Professional</td>
<td>M.A.; B. Lib., M.L.I.S.</td>
</tr>
<tr>
<td>6.</td>
<td>Asrar Husain</td>
<td>JLA(Stores)</td>
<td>M. Com.; B.Com.</td>
</tr>
<tr>
<td>9.</td>
<td>Farid Mohammad</td>
<td>Office Attendant</td>
<td>High School</td>
</tr>
<tr>
<td>10.</td>
<td>Munney Khan</td>
<td>Office Attendant</td>
<td>8th</td>
</tr>
<tr>
<td>11.</td>
<td>Dhuru</td>
<td>Safaiwala</td>
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</table>
SPONSORED PROJECTS & CONSULTANCY

COMPLETED RESEARCH PROJECTS OF THE DEPARTMENT:

*Project Title*: Application of Macro cyclic Compounds in the Management of Hazardous Wastes.

The council of Science & Technology, UP has sanctioned financial assistance of ₹ 9.0 lakh of Three Years under Young Scientist Scheme to the Department of Chemical Engineering (CST/SERP D/D-3474 dated 19 March 2008) on the Research Proposal entitled, Application of Macro cyclic Compounds in the Management of Hazardous Wastes, submitted by Prof. Mohammad Idrees and Dr. Shah Mohammad Shadab. The work shall be carried out by Dr. S.M. Shadab in the Hazardous Waste Management research laboratory of Prof. M. Idrees.

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<tr>
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<tr>
<td>Principal Investigator</td>
<td>Prof. Mohammad Idrees</td>
</tr>
<tr>
<td>Co- Principal Investigator</td>
<td>Dr. Shah Mohammad Shadab</td>
</tr>
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*Project Title*: Application of Macrocyclic Compounds in the Management of Hazardous Wastes.  
*Period*: 2008-2011

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<td>Prof. Mohammad Idrees</td>
</tr>
<tr>
<td>Co- Principal Investigator</td>
<td>Dr. Shaadab Ahmad</td>
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*Project Title*: To develop and to Implement a Process Safety Management Program

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<td>Prof. S. S. Alam</td>
</tr>
<tr>
<td>Co- Principal Investigator</td>
<td>Dr. M.J. Khailil, Dr. M. Idrees, N.A.Khan</td>
</tr>
</tbody>
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ON GOING RESEARCH PROJECTS OF THE DEPARTMENT:

*Project Title*: Designing a N-heterocyclic carbine based MOFs: Application in gas storage, separation and in catalysis

<table>
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<tr>
<td>Principal Investigator</td>
<td>Prof. Mohammad Idrees</td>
</tr>
<tr>
<td>Co-Principal Investigator</td>
<td>Dr. Sarvendra Kumar, working as Young Scientist since Oct 2013 but has gone to Japan for the last few months for PDF</td>
</tr>
</tbody>
</table>
**Project Title:** Environmental friendly Management of Hazardous Electroplating Waste: A Zero Discharge Plan

The project is in progress since January 2013 and of 3 year duration. Dr. Shah Mohammad Shadab is working as Project Fellow.

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<tr>
<td>Co-Principal Investigator</td>
<td>Dr. Shah Mohammad Shadab, Project Fellow</td>
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**CONSULTANCY:**

**Title:** Study on ‘Sulphur Recovery Units (SRU) Performance at Mathura Refinery’. **Period:** 2009-2010

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<tr>
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<td>Prof. Mohammad Idrees</td>
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<tr>
<td>Co-Principal Consultant</td>
<td>Dr. S. Akhlaq Ahmad</td>
</tr>
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**Title:** Process Design Vetting of the Three Projects of ‘AGRA WATER SUPPLY PROJECT’ related to Water Treatment Plan designed by NJS Consultants Co. Ltd. Japan. **Period:** 2010-2011

<table>
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<tbody>
<tr>
<td>Funding Amount</td>
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</tr>
<tr>
<td>Principal Consultant</td>
<td>Prof. Mohammad Idrees</td>
</tr>
<tr>
<td>Co-Principal Consultant</td>
<td>-</td>
</tr>
</tbody>
</table>
DEPARTMENTAL LABORATORIES/RESEARCH FACILITIES

CAD/SIMULATION LAB:
The department has well maintained CAD/Simulation Lab with more than thirty computers; all of them are having internet connectivity through LAN. This lab also provides Wi-Fi networking to other systems PCs/ Laptops through installed routers. The Lab is available to the faculty members, Ph.D., P.G. and U.G. students of the department. This is also used for practical classes of U.G., P.G. students; Lab has also been used for holding workshops and training programs. There is a dedicated high speed server, on which popular engineering software like ASPEN PLUS, CHEMCAD, and MATLAB are installed.

LIBRARY:
The department also has a small library with a seating capacity of 20 persons and contains around 1100 books. Besides, it also contains national / international journal volumes, chemical engineering encyclopaedias such as Kirk Othmer and Ullmann’s, design codes, reports, theses, dissertations, symposium volumes etc.
FLUID PARTICLE OPERATION LAB:
Various experimental facilities are available for the study of different fluid particle operations including size reduction techniques and conveying of the granular materials. This lab houses ball mill, jaw crusher, pulveriser, Wiley mill etc. which are used in studying their crushing efficiencies. Setups for plate and frame filter press, gravity thickening, sedimentation are also available for experimentation.
FLUID MECHANICS LAB:
Fluid Mechanics laboratory houses various equipment covering practical aspects of fluid flow phenomena and their properties. This lab provides hands on training on the following equipment: flow through straight circular tube, Bernoulli’s apparatus, orifice & venturi meter, capillary flow viscometer, fluidized bed equipment and centrifugal pump etc. The lab also has some research set-ups such as flow through helical coil and flow through spiral coil.
HEAT TRANSFER LAB:
The Heat Transfer lab of the department provides practical training to the students on various heating and cooling systems of different configuration e.g. Cross flow, Parallel flow, counter flow heat exchangers and evaporative systems along with the basic understanding of the study of heat transfer phenomena in boiling, condensation and convection systems etc.

Mass Transfer Lab:
The Mass Transfer Lab of the department provides practical training to the UG students on various mass transfer equipment covering all the basic aspects of mass transfer phenomena. The Lab is equipped with the experimental setups for doing experiments on solid-liquid, liquid-liquid extraction, drying and distillation operations etc.
PROCESS CONTROL AND INSTRUMENTATION LAB:
Process Control and Instrumentation Laboratory provides the basic knowledge of instruments such as Level measuring, Temperature measuring, Flow measuring, Pressure measuring instruments etc. In this lab, the students also become familiar with the controller such as PID controller, Temperature Control System and Multi Process Control System which is widely used in the Chemical Industries.
REACTION ENGINEERING & THERMODYNAMICS LAB:
The Departmental reaction engineering lab provides practical training to the UG students on several basic reaction engineering equipment covering elementary aspects of reaction engineering. These include RTD studies in a single CSTR/ series of CSTRs / tubular reactor, kinetic studies for fluid solid reaction, kinetic studies for liquid phase reaction in a plug flow reactor/ batch reactor. Beside the above mentioned experiments, some are developed in house such as RTD studies in different packed beds and kinetic studies in a CSTR.

PROCESS DEVELOPMENT LAB:
Chemical process research and development is recognized as a key function during the commercialization of a new product particularly in the generic and contract manufacturing arms of the chemical, agrochemical, food industries and pharmaceutical industries. In this laboratory, the students become familiar with the following experiments such as Extraction of edible oil, Essential oil, Cement analysis, Milk adulteration, Dehydration of fruits & vegetables, Making of Bio- Diesel and Polymer resins etc.
HEAT TRANSFER RESEARCH LAB:
To facilitate the higher research work in the area of heat transfer, the department has a fully dedicated experimental facility of Thermo-siphon reboiler equipped with the SCADA system, and heating arrangement by steam. This lab has been quite helpful in completing several Ph.D. and M.Tech. dissertations on the above mentioned subject. Apart from this, the lab also consists of inclined thermo-siphon facility, boiling heat transfer systems, and heat transfer on coiled geometries of various configuration.
COURSE STRUCTURE
# Course Structure of B.Tech. (Chemical Engineering)

## 1st Semester, First Year B.Tech. (Chemical Engineering)

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<td>Departmental Elective- III</td>
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<td>CH 4--</td>
<td>Departmental Elective- IV</td>
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<td>5.</td>
<td>OE</td>
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<td>DC</td>
<td>CH 493</td>
<td>Process Control &amp; Instrumentation Lab</td>
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<td>CH 499</td>
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</table>

1. Four weeks training after 2nd /3rd year. Evaluation shall be done in 7th semester.
2. ’I’ grade shall be awarded which shall be withdrawn next semester after final exam.
### Departmental Elective (DE) for the students of B.Tech. (Chemical Engg.)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course No.</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>VI</td>
<td>CH 331</td>
<td><strong>Industrial Biotechnology</strong></td>
</tr>
<tr>
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<td>CH 332</td>
<td><strong>Biomedical Engineering</strong></td>
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<tr>
<td></td>
<td>CH 333</td>
<td><strong>Fermentation and Enzyme Engineering</strong></td>
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<td>CH 334</td>
<td><strong>Genetic Engineering</strong></td>
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<tr>
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<td>CH 335</td>
<td><strong>Bioprocess Engineering</strong></td>
</tr>
<tr>
<td>VII</td>
<td>CH 440</td>
<td><strong>Nanotechnology</strong></td>
</tr>
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<td></td>
<td>CH 441</td>
<td><strong>Green Technology in Process Industries</strong></td>
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<tr>
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<td>CH 442</td>
<td><strong>Petroleum Processing</strong></td>
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<td>CH 443</td>
<td><strong>Polymer Science &amp; Technology</strong></td>
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<td>CH 444</td>
<td><strong>Agro Process Technology</strong></td>
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<td>CH 445</td>
<td><strong>Food Science &amp; Technology</strong></td>
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<td>CH 446</td>
<td><strong>Oil Technology</strong></td>
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<td>CH 447</td>
<td><strong>Paint Technology</strong></td>
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<td>CH 448</td>
<td><strong>Ceramic Technology</strong></td>
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<td>CH 449</td>
<td><strong>Plastic Technology</strong></td>
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<td>CH 450</td>
<td><strong>Fertilizer Technology</strong></td>
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<tr>
<td></td>
<td>CH 451</td>
<td><strong>Pulp &amp; Paper Technology</strong></td>
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<tr>
<td></td>
<td>CH 452</td>
<td><strong>Leather Technology</strong></td>
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<td>VIII</td>
<td>CH 453</td>
<td><strong>Environmental Pollution Control</strong></td>
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<td>CH 454</td>
<td><strong>Industrial Pollution Control</strong></td>
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<tr>
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<td>CH 455</td>
<td><strong>Industrial &amp; Municipal Solid Waste Management</strong></td>
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<tr>
<td></td>
<td>CH 456</td>
<td><strong>Industrial Safety and Hazard Management</strong></td>
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<tr>
<td></td>
<td>CH 457</td>
<td><strong>Industrial Pollution Abatement &amp; Waste Minimization</strong></td>
</tr>
<tr>
<td>VIII</td>
<td>CH 460</td>
<td><strong>Colloidal and Surface Science</strong></td>
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<td>CH 461</td>
<td><strong>Fluidization Engineering</strong></td>
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<td>CH 462</td>
<td><strong>Advanced Separation Techniques</strong></td>
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<td>CH 463</td>
<td><strong>Advanced Transport Processes</strong></td>
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<td>CH 464</td>
<td><strong>Membrane Science and Technology</strong></td>
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<td><strong>Industrial Rheology</strong></td>
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<td>CH 466</td>
<td><strong>Process Heat Transfer</strong></td>
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<td>CH 467</td>
<td><strong>Nuclear Chemical Engineering</strong></td>
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</table>
The table below lists the open electives offered by the Department of Chemical Engineering for Semester VII and VIII:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CH 421</td>
<td>Appropriate Technology for Rural Development</td>
</tr>
<tr>
<td>CH 422</td>
<td>Industrial Pollution Abatement and Control</td>
</tr>
<tr>
<td>CH 423</td>
<td>Industrial Safety Engineering</td>
</tr>
<tr>
<td>CH 424</td>
<td>Modeling of Dynamic Systems</td>
</tr>
<tr>
<td>CH 425</td>
<td>Design of Piping System</td>
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<tr>
<td>CH 426</td>
<td>MATLAB for Scientist &amp; Engineers</td>
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<tr>
<td>CH 474</td>
<td>Chemical Engineering Simulation</td>
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<td>CH 427</td>
<td>Solid Waste Management</td>
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<tr>
<td>CH 428</td>
<td>Computer Aided Design</td>
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<tr>
<td>CH 429</td>
<td>Optimization Techniques</td>
</tr>
<tr>
<td>CH 430</td>
<td>Design of Experiments and Parameter Estimation</td>
</tr>
<tr>
<td>CH 431</td>
<td>Hazardous Waste Management</td>
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<tr>
<td>CH 432</td>
<td>Project Engineering &amp; Management</td>
</tr>
<tr>
<td>CH 433</td>
<td>Historical Development of Scientific Thoughts</td>
</tr>
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<td>CH 434</td>
<td>Graph Theory &amp; its Applications in Engineering</td>
</tr>
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<td>CH 435</td>
<td>Process Modeling and Simulation</td>
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<tr>
<td>CH 436</td>
<td>Organizational Behaviour</td>
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<tr>
<td>CH 437</td>
<td>History of Science and Technology</td>
</tr>
<tr>
<td>CH 438</td>
<td>Cultural, Social and Educational Movements of India</td>
</tr>
<tr>
<td>CH 439</td>
<td>Nanomaterials</td>
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Open Electives (OE) I and II for the students of B.Tech. (Chemical Engg.):
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>1.</td>
<td>CO 304 Data Base Management System</td>
</tr>
<tr>
<td>2.</td>
<td>AP 305 Atmospheric Physics</td>
</tr>
<tr>
<td>3.</td>
<td>AC 308 Atmospheric Chemistry</td>
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<tr>
<td>4.</td>
<td>AP 309 Nano Physics and Technology I</td>
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<tr>
<td>5.</td>
<td>EE 485 AI and Soft Computing</td>
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<td>6.</td>
<td>EL 432 AI and Neural Network</td>
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<td>7.</td>
<td>PK 422 Computer Aided Process Control</td>
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<td>8.</td>
<td>ME 425 Air Pollution Technology</td>
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<tr>
<td>9.</td>
<td>AP 410 Nano Physics and Technology II</td>
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<tr>
<td>10.</td>
<td>CO 446 Fundamentals of Computer Technology</td>
</tr>
<tr>
<td>11.</td>
<td>EL 432 Artificial Intelligence &amp; Neural Networks</td>
</tr>
<tr>
<td>12.</td>
<td>ME 441 Entrepreneurship</td>
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<tr>
<td>13.</td>
<td>ME 461 Heating, Ventilation &amp; Air-conditioning</td>
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<td>14.</td>
<td>ME 435 Finite Elements Methods</td>
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<td>15.</td>
<td>AM 443 Advanced Numerical Methods</td>
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<td>16.</td>
<td>PK 432 Safety &amp; Risk Assessment in Hydrocarbon Industries</td>
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<td>17.</td>
<td>AP 407 Nuclear Chemical Engineering</td>
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<td>18.</td>
<td>ME436 Computational Fluid Dynamics</td>
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<td>19.</td>
<td>AP 304 Bio-Physics</td>
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<td>20.</td>
<td>CH 421 Appropriate Technology for Rural Development</td>
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<td>21.</td>
<td>CH 422 Industrial Pollution Abatement and Control</td>
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<td>22.</td>
<td>CH 423 Industrial Safety Engineering</td>
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<td>23.</td>
<td>CH 424 Modeling of Dynamic System</td>
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<td>24.</td>
<td>CH 425 Design of Piping System</td>
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<td>25.</td>
<td>CH 426 MATLAB for Scientist &amp; Engineers</td>
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<td>26.</td>
<td>CH 444 Chemical Engineering Simulation</td>
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<td>CH 4  Solid Waste Management</td>
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<td>28.</td>
<td>CH 428 Computer Aided Design</td>
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<td>CH 429 Process Optimization</td>
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<td>CH 430 Design of Experiments and Parameter Estimation</td>
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<td>31.</td>
<td>CH 4 Hazardous Waste Management</td>
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<td>32.</td>
<td>CH 432 Project Engineering &amp; Management</td>
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<td>33.</td>
<td>CH 433 Historical Development of Scientific Thoughts</td>
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<td>34.</td>
<td>CH 434 Graph Theory &amp; its Applications in Engineering.</td>
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<td>CH 435 Process Modeling and Simulation</td>
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<td>38.</td>
<td>CH 438</td>
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<td>DC</td>
<td>60-116</td>
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<td>DE</td>
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<td>OE</td>
<td>8-16</td>
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</table>
DEPARTMENT OF APPLIED CHEMISTRY

Course Number and Title  | AC-111, Applied Chemistry
--- | ---
Credits | 04
Course Category | Basic Sciences (BS)
Pre-requisite(s) | NIL
Contact Hours (L-T-P) | 3-1-0
Type of Course | Theory
Course Assessment | Course Work (Home assignments, tutorials and quizzes) (15%)
 | Mid-Semester Examination (1 hour) (25%)
 | End-Semester Examination (3 hour) (60%)

COURSE OBJECTIVES
To impart the knowledge of applications of chemical sciences in the field of engineering and technology.

COURSE OUTCOMES
After completion of the course the students shall be able to understand:

1. The basic knowledge of methods of chemical analysis and the instrumentation involved
2. Water treatment procedures for municipal and industrial uses.
3. About solid, liquid and gaseous fuels
4. About lubricants, types and their applications
5. About corrosion and techniques to control corrosion
6. About polymers and their applications

SYLLABUS

Unit-I: Methods of Chemical Analysis
Introduction to chemical analysis, Classification, Qualitative and gravimetric analysis, (quantitative analysis) Principle of gravimetry. The steps involved in gravimetric analysis, with special emphasis on precipitation, Digestion, Favorable conditions for precipitation, Von-Wiemann ratio, Types of precipitates, Impurities in precipitates and their minimization. Volumetric Analysis, Titration, Titrant, Analyte Basic requirements of titrimetric method. Primary and Secondary standards, Basic requirements of primary standard. Types of titrations, Acid-Base Titration (strong acid versus strong base, pH Titration curve) Redox titration (Iodimetry, Iodometry), Precipitation titration (Silver nitrate versus sodium chloride), Chelometric titration (Ca^{2+}/Mg^{2+} versus EDTA). Absorption Spectrophotometry, Beer and Lambert’s law (definition and units of terms involved, deviation from Beer Lambert’s law, numerical problems), block diagram of single beam UV – Visible Spectrophotometer. Definition of chromatography, Stationary and mobile phases, Classification of chromatography on the basis of physical mode and mechanism (adsorption, partition, size exclusion and ion exchange), RF Value.

Unit-II: Treatment of Water for Municipal and Industrial Use
Uses of water for municipal and industrial purposes, Sources of water, Impurities in water, Requirements of water for municipal use, Municipal water treatment methods, Plain sedimentation, Sedimentation with coagulation and filtration. Disinfection, Requirements of a good disinfectant, Types of disinfecting agents (Bleaching powder, Liquid chlorine, Ozone, UV radiations and Chloramine), Break point chlorination, Advantages of break point chlorination, super chlorination
and dechlorination Requirements of water for industrial use, Hardness of water, Units of hardness, Calculation on hardness, Theories of estimation of hardness by soap and EDTA methods. Boiler defects (Sludge and scale formation, Priming and foaming), Boiler corrosion and caustic embrittlement (Causes and prevention). Removal of hardness, Lime-soda process, Zeolite process, Ion-exchange process Advantages and limitations of the process, Calculations based on lime – soda process.

Unit-III: Fuels and Combustion

Definition of fuels, Classification of fuels, Calorific value and its determination by bomb calorimeter, Delong’s formula. Coal, Coal analysis (Boximate and ultimate analysis), Significance of constituents of coal Petroleum, Classification and important fractions of petroleum and their uses (Petrol, Diesel, Lubricating oils), Synthetic petrol (Synthesis by polymerization, by cracking by Fisher Tropsch process by Bergius process) Gaseous fuels (CNG, LPG), Advantages and disadvantages of gaseous fuels, Combustion calculations based on solid and liquid fuels.

Unit-IV: Lubricants and Lubrication

Definition and classification of lubricants, Functions of lubricants, Lubrication (Types of lubrication and their mechanisms).Liquid lubricants (Mineral oils, Fatty oils, Compounded oils and Silicone fluids)Greases types of greases and conditions of their use, Testing of greases, Solid lubricants and conditions of their use. Testing of liquid lubricants (Viscosity and viscosity index, Flash and fire points, cloud, pour and setting points, Saponification value, Aniline point), Selection of lubricants (Cutting tools, Internal combustion engine, Transformer, Refrigerators).

Unit-V: Corrosion and Its Prevention


Unit-VI: Polymers

Definition and classification of polymers (On the basis of origin, synthesis, thermal response, physical state, applications, chemical structure) Polymerization (Addition and condensation), Mechanism of free radical addition polymerization of vinyl chloride, Difference between thermoplastics and thermosetting. Thermoplastics (Preparation, properties and uses of PE, PVC, Nylons, PTFE) Thermosetting plastics (Preparation, properties and uses of Bakelite, polyesters) Elastomers (Preparation, properties and uses of NR, BUNA rubbers), vulcanization.

Suggested Readings/Text/References

**DEPARTMENT OF APPLIED MATHEMATICS**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>AM-111, Mathematics –I</th>
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<tbody>
<tr>
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<td>Type of Course</td>
<td>Theory</td>
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<tr>
<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
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<tr>
<td></td>
<td>Mid-Semester Examination (1 hour) (25%)</td>
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<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

To learn the fundamental concepts of matrices, differential and integral calculus, the theory of differential equations, applications.

**COURSE OUTCOMES**

After completing this course the students should be able to:

1. apply tools of the theory of matrices to relevant fields of Engineering.
2. understand curve tracing and regions between different curves.
3. expand important mathematical functions in power series and their applications.
4. apply tools of integration to find length, surface area and volume.
5. express real life problems into mathematical models using differential equations and analyse their solutions.

**SYLLABUS**

**Unit-1**

Rank of a matrix with applications to consistency of a system of linear equations, Eigen-values and Eigen vectors of a matrix, Caley - Hamilton theorem.

**Unit-2**

Asymptotes and simple curve tracing, successive differentiation, Leibnitz’s theorem, Taylor And Maclaurin series with remainder terms.

**Unit-3**

Applications of integration to lengths of curves, surfaces and volumes of solids of revolution.

**Unit-4**

Solution of exact differential equations, linear differential equations of second and higher order with constant coefficients, homogeneous differential equations, simultaneous linear differential equations, applications to physical problems.

**Text Book(s)/Reference Book(s)**

DEPARTMENT OF MECHANICAL ENGINEERING

**Course Number and Title**  
ME 101 Basic Thermal Science

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course Category</th>
<th>Pre-requisite(s)</th>
<th>Contact Hours (L-T-P)</th>
<th>Type of Course</th>
<th>Course Assessment</th>
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<tbody>
<tr>
<td>04</td>
<td>ESA</td>
<td>NIL</td>
<td>3-1-0</td>
<td>Theory</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%) Mid-Semester Examination (1 hour) (25%) End-Semester Examination (3 hour) (60%)</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

At the end of this course the student will

1. Be able to have the basic concepts of thermal sciences and their application to in formulating the thermal engineering problems.
2. Have a good understanding of first and second laws of thermodynamics and will be in
3. A position to fully understand the analysis to be taught at the higher levels.
4. Be in a position to check the feasibility of proposed processes and cycles using the ideas of second law of thermodynamics and entropy.
5. Have the understanding of basic principles of heat transfer and related simple problems.

**COURSE OUTCOMES**

After taking this course the students shall be able to have:

1. The basic concepts of units and dimensions, systems(open and closed systems and control volumes) and its boundaries, properties, state, process, cycle, quasi-static process etc.- required as foundation for development of principles and laws of thermodynamics
2. Intuitive problem solving technique
3. Knowledge of two property rule and hence thermodynamic tables, thermodynamic diagrams and concept of equation of state; also their simple application.
4. Heat, work and first law of thermodynamics. Application of energy balance
5. Second law of thermodynamics and its corollaries viz. absolute (thermodynamic) temperature scale, reversibility, entropy, feasibility of a process based on first law and second law, isentropic efficiency of adiabatic machines.
6. Introductory knowledge of power and refrigeration cycles. Their efficiencies and coefficients of performance.
7. Introductory ideas of heat transfer in conduction, convection and radiation modes. Application of these concepts to heat transfer in single and combined modes.
SYLLABUS

Unit –I
Dimensions and units, system, boundary, types of systems and boundaries, property, cycle, thermodynamic equilibrium and quasi-static process. Pressure and its measurement, zero’th law of thermodynamics, temperature and its measurement, numerical problems.

Unit-II
Thermodynamic and mechanics’ definition of work, displacement work and its expressions, engine indicator and indicated work, introduction to 2-stroke and 4-stroke engines, heat, work and heat as energy interactions, Joule’s experiment & mechanical equivalent of heat, first law of thermodynamics for cyclic and non cyclic processes, definition of energy as a property, internal energy, enthalpy, specific heats, first law for a control volume, steady flow energy Equation (SFEE), and its applications, numerical problems.

Unit-III
Pure substance, different phases of pure substance, two-property rule, property diagrams, tables and charts, equation of state of an ideal gas, t–τ, t–p, p–v, and p–h diagrams, phase boundaries, S–L–V region, CP and TP, dryness fraction and its measurement using throttling calorimeter, limitation of throttling calorimeter, separating & throttling calorimeter, numerical problems.

Unit-IV
Limitations of first law, heat engine, heat pump, refrigerator, second law of thermodynamics-Kelvin Planck’s and Clausius statements and their equivalence, efficiency of heat engine and coefficient of performance of heat pump and refrigerator, reversible and irreversible processes, Carnot cycle and its efficiency, corollaries of second law, the thermodynamic temperature scale, inequality of Clausius, entropy, principle of increase of entropy, isentropic process, t–s and h–s diagrams (Mollier chart), second law applications, air standard Otto, diesel, dual, simple Brayton and steam power cycles (Rankine cycle), numerical problems.

Unit V
Modes of heat transfer, Fourier’s law of steady state heat conduction (one dimensional conduction), thermal conductivity and its unit, conduction through slab or plane wall, hollow cylinders and spheres conduction through composite walls and hollow cylinders and spheres with multi-layers, convective heat transfer, Newton’s law of cooling, electrical analogy and overall heat transfer coefficient, combined conductive and convective heat transfer, radiation and radiation properties of surfaces, black body, emissive power, Stefan Boltzmann’s law, emissivity, monochromatic emissive power and monochromatic emissivity, grey body, Kirchhoff’s law, Wien’s displacement law, numerical problems.

Reference Books:
1. Thermodynamics, An Engineering Approach by Yunus A. Cengel and Michael A Boles
3. Engineering Thermodynamics by R. Joel
DEPARTMENT OF ELECTRICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>EE-111 Basic Electrical and Electronics Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>04</td>
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<tr>
<td>Course Category</td>
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<td>Pre-requisite(s)</td>
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<td>Contact Hours (L-T-P)</td>
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<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

The objective of this course is to set a firm and solid foundation in Electrical & Electronics Engineering with strong analytical skills and conceptual understanding of theorems and analysis methods in electrical and magnetic circuits, electronic devices, circuits, measuring instruments. The course will familiarize students with various motors, transformers, power generation system.

**COURSE OUTCOMES**

After successful completion of this course, the students will be able to:

1. Analyze electrical and magnetic circuits with moderate complexity applying fundamental laws and theorems in steady-state as well as transient operation.
2. Analyze AC circuits using phases.
3. Converse with transformers, motors, measuring instruments.
4. Understand various methods of electrical generation.
5. Identify schematic symbols and understand the working principles of electronic devices e.g. Diode, Zener Diode, LED, BJT, JFET and MOSFET etc.
6. Understand the working principles of electronic circuits e.g. Rectifiers, Amplifiers and Operational Amplifiers etc.
7. Understand methods to analyze and characterize these circuits.

**SYLLABUS**

**PART A**

**Unit I: Circuit and Transformers**

Review of dc circuits and theorems, 1-phase circuits, superposition theorem, the venin’s theorem and Norton’s theorem for ac circuits, RLC series and parallel circuits, 3-phase balanced ac circuits. Magnetic circuits, magnetization curve, hysteresis & eddy current effect/losses. Transformer construction, Equivalent circuit, calculation of losses and efficiency.

**Unit II: Introduction to electrical machines, instruments and power system:**

3-phase induction motor and 1-phase induction motors. Basic elements of an instrument: MC, MI instruments, dynamometer wattmeter, digital energy meter. Elements of power system, layout of thermal, hydro, nuclear and gas plants. Introduction to renewable energy sources and recent trends in generation.

**PART B**

**Unit III: Diode and BJT:**
Terminal characteristics of diodes, diodes models; Ideal, constant voltage and piecewise linear, load line concept, Diode applications; Rectifier, logic gates, Zener diode; Operation, characteristics, voltage regulation. Bipolar Junction Transistor; Construction, operation, configurations, characteristics of common emitter configuration, DC load analysis.

**Unit IV: MOSFET and OpAmp:**
Introduction to MOSFET; Depletion MOSFET construction, operation, Enhancement MOSFET construction, Operation, amplifiers, Operational Amplifiers; equivalent circuit, ideal behavior, open loop and closed loop concept, concept of virtual short, simple Op Amp applications; Unity gain amplifier, inverting, non-inverting, integrator, differentiator, subtractor, summer.

**Text Book(s)/Reference Book(s)**

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**DEPARTMENT OF APPLIED CHEMISTRY**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>AC-194. Applied Chemistry</th>
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</thead>
<tbody>
<tr>
<td>Credits</td>
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<td>Course Category</td>
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<td>Pre-requisite(s)</td>
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<tr>
<td>Type of Course</td>
<td>Lab</td>
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<tr>
<td>Course Assessment</td>
<td>Evaluation by viva Voce (60%)</td>
</tr>
<tr>
<td></td>
<td>Endsem Examination (3 Hours) (40%)</td>
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</tbody>
</table>

**COURSE OBJECTIVES**
To trained the students for the applications of the chemical sciences in the field of engineering and technology.

**COURSE OUTCOMES**
After completion of the course the students shall be able to understand:
1. The basic methods of chemical analysis and the instrumentation involved.
2. To estimate the hardness of water.
3. To carry out the proximate analysis of coal and grade the coal for indisutrial purposes.
4. To estimate the drop point of grease and its applications.
5. To study and explore the nature of the corrosion and its control.
6. About the determination of the molecular weight by viscometer.

**SYLLABUS**

**LIST OF EXPERIMENTS:**
1. Determine total, permanent and temporary hardness of water in ppm by versenate method.
2. To determine the amount of dissolved oxygen in water in ppm units.
3. To determine the cloud point, pour point and setting point of an oil.
4. To determine the percentage of available chlorine in the given sample of bleaching powder.
5. To carry out proximate analysis of the given sample of coal.
6. To determine the saponification value and percentage of fatty oil in the given sample of compounded oil.
7. To determine the aniline point of a given sample of an oil.
8. To determine the relative viscosity of an oil by redwood viscometer and to study the variation of viscosity with change in temperature.
9. To demonstate and explore the electrochemical nature of aqueous corrosion. To study the electrochemical methods of corrosion control.
10. To determine the flash point of an oil by Abel’s and Pensky Marten’s apparatus.
11. Determination of iron in a given sample of water with 1, 10 phenanthroline by spectrophotometry.

Suggested Readings/Text/References
1. Lab Manuals provided by the Department

DEPARTMENT OF COMPUTER ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CO-191 COMPUTER PROGRAMMING LABORATORY</th>
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<tbody>
<tr>
<td>Credits</td>
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<td>Course Category</td>
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<td>Type of Course</td>
<td>Lab</td>
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<tr>
<td>Course Assessment</td>
<td>Evaluation by viva Voce (60%)</td>
</tr>
<tr>
<td></td>
<td>Endsem Examination (3 Hours) (40%)</td>
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</tbody>
</table>

**Course Objective**
To make students of all branches of B.Tech familiar with the programming concepts and to implement the algorithmic approach of problem solving in C language to gain working knowledge of C programming.

**Course Outcome**
Students will be able to:
1. Understand programming concepts
2. Develop analytical skills for step by step solution for algorithms.
3. Solve problems through programming.
4. Relate and extend C programming concepts including control statements, strings, Functions and programming techniques to solve computational problems.

**Syllabus**
Introductory discussion of how a computer executes a program. A brief discussion of high level languages, e.g., C, and C++ and low level languages, e.g., assembly language and binary code. An
introduction to the translation i.e. compilation process. Experiments to be conducted in the laboratory consist of, but not limited to, the following:

**LIST OF EXPERIMENTS:**

1. Practice of Turbo C as the development environment
2. Simple introductory algorithms and programs for getting input, printing formatted output etc.
3. Programs introducing elementary C concepts, like variable and names
4. Programs using operators
5. Programs using control structures
6. Programs for repetitive tasks and iterations
7. Programs on arrays and strings
8. Programs introducing the use of function calls
9. Programs introducing basic concept of file handling
10. Programs for using basic concepts of storage classes

**Reference Books/Text Books:**

3. M. Inamullah and S. M. Zakariya. "CO191 Computer Programming Lab Course Content and Practice Schedule", *Department of Computer Engineering, A.M.U.* (This document can be obtained in PDF format from the instructor)

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**DEPARTMENT OF MECHANICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>ME-193 Engineering Graphics Lab</th>
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<td>Credits</td>
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<td>Lab</td>
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<td>Course Assessment</td>
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</tr>
<tr>
<td></td>
<td>Endsem Examination (3 Hours) (40%)</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES:**

1. To understand and appreciate the importance of Engineering Graphics.
2. To understand the basic principles of Technical/Engineering Drawing.
3. To understand the different steps in producing drawings according to BIS.
4. To learn basic engineering drawing formats.

**COURSE OUTCOMES:**

After taking this course students should be able to:

1. Understand the theory of plane geometric projection and its classifications.
2. Use Plane/diagonal/isometric scales in engineering graphics.
3. Apply various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient.
4. Read and interpret drawings of simple machine parts/sectional views in first and third angle of projection systems.
5. Explain the conventions and the methods of orthographic projection and isometric projection.
6. Improve their visualization skills so that they can apply these skills in developing new products.
7. Model simple machine parts in isometric projections.
8. Develop skills to communicate ideas and information through engineering drawing.

SYLLABUS:
Unit-1:

Unit-2:
Necessity for orthographic projections 1st & 3rd angle methods of projection.Projection of points & lines on three coordinate planes, Projections of plane surfaces.

Unit-3:

Unit-4:

Text Books:


DEPARTMENT OF APPLIED PHYSICS

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<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
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<td>Mid-Semester Examination (1 hour) (25%)</td>
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<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
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</table>
COURSE OBJECTIVE:

To equip the student with a strong understanding of the fundamentals of physics so as to enable him/her to apply it to his/her field of study.

This course should enable the student to-

1. Explain the behavior of the physical world around him/her
2. Apply the concepts of physics in his/her field of study
3. Relate the concepts of physics to the advancement of technology.
4. Understand and relate the different phenomena in the world.
5. Approach problems, predict their results in advance, and solve them in quantitative and qualitative manner.
6. Gain a broader understanding of other sciences.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

1. Recognize and present real life examples of the aforementioned concept and interrelate some of them.
2. Describe the link between physics and the technology.
3. Identify technological applications of some of the aforementioned concepts.
4. Describe how he/she can harness the benefits of some of the aforementioned concepts to his /her area of specialization.
5. Understand the professional and ethical responsibilities of the subject.
6. Communicate effectively while speaking, employing graphics and writing.

SYLLABUS

Unit 1. Masers and Lasers

Basic principle, Einstein coefficients for Induced absorption, Spontaneous emission and Induced emission, Ammonia maser and its applications, Ruby and He-Ne Lasers, Semiconductor laser, Spatial and temporal coherence, Characteristics of lasers and its applications based on these characteristics (such as in Industry, Science, Medicine, Communications, Surveying, Holography, Fusion reactors, Isotope separation, etc.).

Fiber Optics:

Basic principle, Fiber construction and dimensions, Light propagation in fibers, Numerical aperture of the fiber, Step index and graded index fibers, Signal distortion in optical fibers, Transmission losses, Light wave communication in optical fibers, Fiber optics in medicine and industry.

Unit 2. Semiconductors:

Elemental and compound semiconductors, Energy bands, Direct and indirect semiconductors, Electrons and holes, Effective mass, Intrinsic material, Extrinsic material, Fermi level, Electron and hole concentration at equilibrium, Temperature dependence of carrier concentrations, Compensation and space charge neutrality, Conductivity and mobility, Hall effect in semiconductors.
Superconductivity:
Zero resistivity, Meissner effect, Type I and Type II Superconductors, High temperature superconductors, BCS theory (qualitative), Josephson Effect, SQUIDS.

Unit 3. Particles and Waves:
Mechanism of X-ray production (continuous and characteristic X-rays, Duane-Hunt limit), Compton Effect, Pair production, Phase and group velocities, Uncertainty principle.

Quantum Mechanics:
Introduction to quantum mechanics, Wave function, Conditions necessary for physically acceptable wave function, Probability density and probability, Schrödinger equation (Time dependent form and Steady state or time independent form), Eigenvalues and Eigen functions, Expectation values, Particle in a box (Infinite square potential well), Tunnel effect (qualitative).

Unit 4. Statistical Mechanics:
Statistical distributions, Maxwell–Boltzmann statistics, Molecular energies in an ideal gas, Quantum statistics, Specific heats of solids, Free electron in a metal, Electron-energy distribution.

Nuclear Physics:
Q-value and threshold energy of nuclear reactions, Cross section of a nuclear reaction and reaction rate, Breeder reactors, Fusion reactors, Nuclear detectors (names and general working principle), Gas filled detectors, Scintillation detectors.

Text and Reference Books:

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>AM-112, Mathematics –II</th>
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<tr>
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<td>Course Category</td>
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<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
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</table>
**COURSE OBJECTIVES**

To learn partial differentiation, multiple integration, polar forms of conics, various forms of general equation of second degree and its tracing, applications.

**COURSE OUTCOMES**

After completing this course the students should be able to:

1. understand the theory of functions of several variables and its applications.
2. understand double and triple integrals and use it to find surface area and volume.
3. learn various forms of general equation of second degree and its tracing.
4. understand polar forms of conics.

**SYLLABUS**

**Unit-1**
Partial differentiation, Euler’s theorem, total differential, small errors, change of variables, Jacobians.

**Unit-2**
Taylor series of functions of two variables, approximate calculations, maxima and minima of functions of two variables, Lagrange’s multipliers.

**Unit-3**
Double and triple integrals, change of variables, change of order of integration, applications to area and volume.

**Unit-4**
General equation of second degree, tracing of conics, introduction to polar form of conics.

**Text Book(s)/Reference Book(s)**


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**DEPARTMENT OF ENGLISH**

<table>
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<tr>
<th>Course Number and Title</th>
<th>EN-101, English</th>
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<td>Credits</td>
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<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
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</tbody>
</table>
COURSE OBJECTIVES
To develop reading, writing, communication and presentation skills.

COURSE OUTCOMES
Upon successful completion of this course, it is expected that students will be able to:
1. Develop reading and writing skills.
2. Develop comprehension and interpretative skills.
3. Communicate one’s point of view in both written and verbal formats with clarity and grammatically correct language.
4. Express themselves clearly and appropriately in social and professional fields and strengthen professional etiquette.
5. Develop effective communication and presentation skills so as to maximize their scope for employability.
6. Enhance attitude for observational and analytical learning.

SYLLABUS
Unit-1
Comprehensive questions, summary type as well as short answer type and questions on vocabulary for 10 passages of ‘Basic Scientific English’ by Ewer and Latorre.

Unit-2
Comprehensive questions, summary type or short answer type from ‘Animal Farm’ by G. Orwell.

Unit-3
Comprehensive questions, summary type or short answer type from ‘Time Machine’ by H. G. Wells.

Unit-4
Note taking, note making exercises, report and precise writing exercises.

Unit-5
Grammar, Composition and Spoken English

Text Book(s)/Reference Book(s)
2. George Orwell, “Animal Farm”

DEPARTMENT OF CIVIL ENGINEERING

<table>
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<th>Course Number and Title</th>
<th>CE-111, Environmental Studies</th>
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<td>Course Category</td>
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<td>Pre-requisite(s)</td>
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<td>Contact Hours (L-T-P)</td>
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<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
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<td>Mid-Semester Examination (1 hour) (25%)</td>
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<tr>
<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
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</table>
**Course Objectives:**

1. To understand the basic concept of ecology, atmospheric structure and its chemistry involved.
2. To have a knowledge about the air quality and its standards and how to control air pollution.
3. To have knowledge about Water Quality: Physical, Chemical and Biological parameters.
4. To understand the Water purification processes in natural systems and introduction to Water Treatment Technologies.
5. To know about the wastewater characteristics and wastewater treatment technologies.
6. To have a knowledge about the solid waste management.

**Course Outcomes:**

Upon successfully completing this course in environmental studies, it is expected that student will be able to:

1. Understand fundamental physical and biological principles that govern natural processes.
2. Demonstrate an in-depth understanding of the sub disciplines within environmental studies (i.e. Biology, Chemistry, Physics etc).
3. Communicate environmental scientific information to both professional and lay audiences.
4. Demonstrate an understanding of current environmental challenges.
5. Develop a basic fundamental background for the higher environmental engineering Courses offered in civil engineering department.

**Syllabus:**

**Unit I**

**Unit II**
Air Quality and Standards, Meteorological phenomena and their influence on Air Quality, Lapse rates, Dispersion of Pollutants. Air Pollution Control: Introduction to Particulate and Gaseous pollutant control.

**Unit III**
Water Quality: Physical, Chemical and Biological parameters. Water quality standards, Biochemical (BOD) and Chemical Oxygen Demand (COD). BOD/COD Calculations


**Unit IV**
Water purification processes in natural systems: Dissolved Oxygen (DO), Impact of wastewater discharge on streams, Oxygen Sag Curve.

Introduction to Water Treatment Technologies: Sedimentation, Coagulation and Flocculation, Hardness Reduction, Filtration and Disinfection.
Unit V

Unit VI
Solid Waste: Classification, Sources and Characteristics.
Waste Management: Solid Waste Generation, Collection, Processing and Disposal Methods.

Text Books, Reference Books:

DEPARTMENT OF MECHANICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>ME-111, Applied Mechanics</th>
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<td>Credits</td>
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<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
1. To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of Applied Mechanics.
2. To enhance students’ ability to design by requiring the solution of open ended problems.
3. To prepare the students for higher level courses such as courses in Mechanics of Solids, Mechanical Design and Structural Analysis.

COURSE OUTCOMES:
After taking this course students should be able to:
1. Work comfortably with basic engineering mechanics concepts required for analyzing static structures.
2. Identify an appropriate structural system to study a given problem and isolate it from its environment.
3. Model the problem using good free-body diagrams and accurate equilibrium equations
4. Identify and model various types of loading and support conditions that act on structural systems.
5. Apply pertinent mathematical, physical and engineering mechanical principles to the system to solve and analyze the problem.
6. Communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem.
7. Develop concepts of rigid body kinematics and dynamics with an emphasis on the Modeling, analysis, and simulation of how forces produce motion of rigid body systems.
8. Determine simple dynamic variables and solve simple dynamic problems involving kinematics, energy and momentum.
9. Determine internal actions in statically determinate structures and draw internal action diagrams –Shear Force (SFD) and Bending Moment Diagrams (BMD) for these structures.

Syllabus:
Unit 1:
Fundamental Concepts and principles of Mechanics. Reduction of a system of forces to a force couple system, free body diagrams, equilibrium of rigid bodies in 3 dimensions, reactions, loading indeterminacy and solvability. Friction forces and laws of dry friction. Principle and application of virtual work.

Unit 2:
Analysis of Multiple particle system: Application of Newton’s laws, linear and angular momentum, kinetic energy and work energy principle, principle of impulse and momentum to a system of particles.

Unit 3:
Translation and rotation about a fixed axis, general plane motion, absolute and relative velocity in plane motion, angular momentum of rigid body in plane motion. Problems of motion of rigid bodies and system of rigid bodies, principle of work and energy, conservation of energy for rigid body and a system of rigid bodies.

Unit 4:
Analysis of stress and strain: Mechanical properties, analysis of simple state of stress and strains, elastic constants, example of state of tension, compression and shear.

Unit 5:
Bending shear and torsion: Concept of bending and shear forces in simple beams, Relationship between load, bending moment and shear force. Bending and shear stresses in simple beams, concepts of torsion in circular shafts.

Text Books:

Reference Books:
2. Timoshenko S. and Young DH, Elements of strength of materials, DYNC, New York.
**COURSE OBJECTIVE:**

This course should enable the student to-

1. Build an understanding of the fundamental concepts with the help of experiments.
2. Familiarize the student with the various experiments of the physical world around him/her.
3. Apply the concepts of physics in his/her field of study.
4. Relate the concepts of physics to the advancement of technology.
5. Allow the student to gain expertise in design and maintenance of experiment setup.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to:

1. Recognize and present real life examples of various experiment performed.
2. Describe the link between physics and the technology.
3. Understand and explain data analysis and identify technological applications of the experiments.
4. Describe how he/she can harness the benefits of some of the experiments to his/her area of specialization.
5. Understand the professional and ethical responsibilities of the subject.
6. Communicate effectively while speaking, employing graphics and writing.

**SYLLABUS**

**LIST OF EXPERIMENTS**

1. To determine the moment of inertia, I of a flywheel about its axis of rotation.
2. To determine resistance per unit length, $\sigma$ of a Carey Foster’s Bridge wire and hence to find the difference between the two nearly equal unknown resistances.
3. To determine the modulus of rigidity of the material of a wire, $\eta$ by statically (vertical) method.
4. To determine the refractive index, $\mu$ of the material of a prism for parrot green line in the mercury spectrum.
5. To study the variation of semiconductor resistance with temperature and hence to find the energy-gap, $E_g$ of the semiconductor.
6. a) To study the V-I and power characteristics of a solar cell and also to determine its fill factor.
   b) To study the current versus voltage characteristics of two light emitting diodes (LED) and hence to determine their cut in voltages.

7. To determine the diameters of three thin wires with the help of a He-Ne Laser.

8. To determine the coefficient of thermal conductivity, $K$ of rubber in the form of a tube.

9. To convert a Weston type galvanometer into an ammeter (ranges 5, 10 and 15 A) and a voltmeter (ranges 5, 10 and 15 V).

10. To determine the wavelength, $\lambda$ of yellow line of shorter wavelength in the mercury spectrum with plane transmission grating.

11. To determine the specific rotation, $\alpha_t$ of cane sugar solution in water using a Bi quartz Polari meter.

12. To calibrate a given thermo-couple with the help of a potentiometer.

13. To find the operating voltage of a G.M. counter and to determine the absorption coefficient, $\mu$ of copper for gamma rays from $^{137}$Cs source.

14. a) To draw the graph between various values of capacitance and the corresponding frequencies of a given oscillator and to determine the value of unknown capacitance by using Lissajous Figures.
   b) To draw the graph between various values of inductance and the corresponding frequencies of a given oscillator and to determine the value of unknown inductance by using Lissajous Figures.

15. To determine Hall coefficient, $R_H$ and majority carrier concentration of a given semiconductor sample.

Text and Reference Books

1. Prof. D.S. Srivastava& Dr. Ameer Azam, Laboratory Manual of Applied Physics Experiments, AMU, Aligarh
2. Indu Prakash and Ramakrishna, A Text Book of Practical Physics, KitabMahal, New Delhi.

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>ME 194 Manufacturing Process Laboratory-I</th>
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<td>Lab</td>
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<td>Reports/Viva-Voce (60 Marks) &amp; End sem Examination (2 hour) (40%)</td>
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**Course Outcomes:**

1. Knowledge and understanding of various types of ferrous and non-ferrous materials used for manufacturing processes.
2. Understanding and selection of processes based upon jobs drawings used for manufacturing.
3. Basic knowledge of hot and cold working processes.
4. Selection and knowledge of various tools applied for cold and hot working processes.
5. Exposure and understanding of machine tools required for manufacturability.
6. Analyze the job manufactured from practical relevance point of view.

**Syllabus**

**List of Experiments**

1. To prepare through tennon and mortise joint.
2. To prepare a funnel of GI sheet.
3. To perform filling, drilling and tapping operations.
4. To perform electroplating.
5. Preparation of green sand mould and to perform casting process.
6. To prepare a square headed bolt.
7. To carry out gear cutting by simple indexing.
8. To prepare a single V-but joint by arc welding and study of gas welding process.
9. To perform facing, simple turning, taper turning, threading and knurling operations on a lathe machine.
10. To perform planning and slot cutting operations on shaper and slotter machines.
Course Number and Title | AM-241, Higher Mathematics
---|---
Credits | 04
Course Category | Basic Sciences (BS)
Pre-requisite(s) | AM-111, AM-112
Contact Hours (L-T-P) | 3-1-0
Type of Course | Theory
Course Assessment | Course Work (Home assignments, tutorials and quizzes) (15%)
 | Mid-Semester Examination (1 hour) (25%)
 | End-Semester Examination (3 hour) (60%)

**Course Objectives**

To study vector calculus, Laplace transforms and solution of boundary value problems involving partial differential equations.

**Syllabus**

**Unit 1.** Vector differentiation, scalar fields, gradient of a scalar field, vector fields, divergence and curl of vector fields, solenoidal and irrotational fields, determination of potential functions.

**Unit 2.** Vector integration: line integrals, conservative fields, Gauss divergence theorem, Green’s theorem in a plane, Stokes’ theorem, applications.

**Unit 3.** Laplace transforms, shifting theorems, transform of derivatives and integrals, differentiation and integration of transforms, inverse transforms, applications to single and system of linear differential equations.

**Unit 4.** Boundary value problems: solution of two dimensional Laplace equation in Cartesian and polar coordinates, solution of one dimensional diffusion and wave equations by method of separation of variables.

**Text Book(s)/Reference Book(s)**

DEPARTMENT OF CHEMICAL ENGINEERING

Course Number and Title | CH 211, Basic Principles of Chemical Engineering
---|---
Credits | 04
Course Category | Departmental Core (DC)
Pre-requisite(s) | Nil
Contact Hours (L-T-P) | 3-1-0
Type of Course | Theory
Course Assessment | Course Work (Home assignments, tutorials and quizzes) (15%)
                      | Mid-Semester Examination (1 hour) (25%)
                      | End-Semester Examination (3 hour) (60%)

COURSE OBJECTIVE

To enable the students to learn the basic principles of chemical engineering and their application in writing the mass and energy balance balances to solve the chemical engineering problems.

SYLLABUS:

Unit 1. Units and dimensions, Process Variables, Application of thermodynamics and chemical principles in estimation of physical properties of single and multi-phase system, Stoichiometry.

Unit 2. Material Balance on single and multiple unit processes, Recycle, bypass and purge, Balance on reactive systems.


Text Book:


Reference Books:

5. Sharifa Begum, Process Calculations, Prentice hall of India
COURSE OBJECTIVES:
To introduce our students to the basic concepts and laws of fluid mechanics and their application. This course mainly deals with basic fluid flow phenomena, problem associated with metering and transportation of industrial fluids.

SYLLABUS:

Unit 1.
Continuum concept of matter, Classification of matter based on deformation. The two axioms of Rheology, Fluid and its properties, Newton’s law of viscosity, classification of fluids. Fluid statics: Hydrostatic law, hydrostatic force and buoyancy on submerged bodies, piezometric head, manometer.

Unit 2.
Study of fluid motion: Velocity field streamlines and path lines, Eulerian and Lagrangian approaches to the study of fluid motion, Bernoulli’s Theorem, Continuity equation, Navier –Stokes equation, Concept of stream function, irrotational flow, potential flow, Laminar and turbulent flow, boundary layer concept, Drag and boundary layer separation.

Unit 3.
Dimensional analysis and Study of Similitude: Advantages and limitations of dimensional analysis, methods of dimensional analysis: Buckingham’s pi theorem, Rayleigh’s method, dimensionless groups and their physical significance, Similitude study, principle of geometric, kinematics, dynamics and similarity.

Unit 4.

Textbook:

Reference Book(s):
1. White, Frank M., Fluid Mechanics, McGraw Hill

**DEPARTMENT OF CHEMICAL ENGINEERING**

**Course Number and Title**
CH 214 Fluid -Particle Operations

<table>
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<th>Credits</th>
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<td>Contact Hours (L-T-P)</td>
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<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
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<td>Mid-Semester Examination (1 hour) (25%)</td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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</tbody>
</table>

**COURSE OBJECTIVE:**
To provide knowledge of particle size analysis, size reduction, conveying, storage and separation of particles by filtration, sedimentation and flow through porous media.

**SYLLABUS:**

**Unit 1:**
Characteristics of solid masses. Particle size measurement and sieve analysis size estimation in sub sieve range capacity and effectiveness of industrial screens. Storage of solid masses. Conveying of solids. Classification and design of Industrial Conveyers.

**Unit 2:**
Size reduction: Theory of crushing and grinding, Types of grinding, Laws of comminution size reduction equipment and their selection.

**Unit 3:**

Agitation and Mixing: Agitated vessels, blending and mixing, suspension of solid particles, dispersion operations, agitator selection and scale up.

**Unit 4:**
Text Book:

Reference Books:

Department of Electrical Engineering

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>EE-206 Electrical Engineering</th>
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<td>Credits</td>
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<td>Pre-requisite(s)</td>
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<td>Contact Hours (L-T-P)</td>
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<tr>
<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%) Mid-Semester Examination (1 hour) (25%) End-Semester Examination (3 hour) (60%)</td>
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</table>

Course Objectives
The objectives of the course are to make the student understand
1. The basics of electrical circuits including digital circuits,
2. Electrical-mechanical machines – their construction and characteristics,
3. To understand electrical measurements and
4. Utilization of electrical energy.

Syllabus:
Unit 1. AC Circuit Analysis:
Circuit parameters, forced and transient response, sinusoidal steady state response, series and parallel circuits, three-phase circuits: star and delta connections, relation between line and phase quantities.
Unit 2. AC Machines:
Construction of three-phase transformers, three-phase induction motors and their speed control
techniques: voltage and voltage/frequency control, universal and servo motors, synchronous
motors.

Unit 3. DC Motors:
Construction and types, basic principles of operation, torque expression, characteristics, need of
starter, PM motors, speed control, series, shunt and separately excited motors.

Unit 4. Electrical Measurement and Utilization:
Principles of Electrical measurements, errors in measurements, measurement of power in 3
phase circuit, Hall effect current probes and power meters, static energy meters. Advantages of
electrical heating, different types of heating methods, induction furnaces, dielectric heating.

Unit 5. Digital Circuit Basics: Introduction to microprocessor, Registers, ROM, RAM,
Microprocessors Architecture, Assembly language programming

Text Book:
2. B.Ram, ‘Fundamentals of Microprocessors and Microcomputers: Dhanpat Rai and Sons
Publications New Delhi

Reference Books:
New Delhi.
Delhi

DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
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<th>Course Number and Title</th>
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<td>Course Assessment</td>
<td>Report Preparation and Submission</td>
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<td>Viva-voce and/or Practical</td>
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<td><strong>Total</strong></td>
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<td><strong>Grand Total</strong></td>
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</table>
COURSE OBJECTIVES:
The course is designed so that the chemical engineering students get familiarized and become well versed with the various commonly available mathematical softwares.

LIST OF PROBLEMS:

Using Ms Excel:
1. Graph Plotting
2. Copying, pasting and Auto filling
3. Solution of system of linear equations
4. Regression Analysis
5. Solution of non Linear equation
6. Optimization using Solver

Using MATLAB
1. Graph Plotting
2. Root of single equation
3. Solution of system of non Linear equation
4. Solution of simultaneous equation using different methods
5. Finding Eigen value / Jacobian of matrix

Reference Books:

DEPARTMENT OF ELECTRICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
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<td>Viva-voce 20 Marks</td>
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<td>Sessional 60 Marks</td>
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<td>Grand Total 100 Marks</td>
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COURSE OBJECTIVES:
The objective of the course is to expose the students to basic operation of DC and AC machine, circuit, instruments, transducers on actual/practical circuit.
SYLLABUS:

List of Experiments

All 08 experiments are to be performed.

1. To conduct open circuit and short circuit test on single phase transformer.
2. To conduct load test on DC shunt motor and plot various characteristics.
3. To conduct load test on DC series motor and plot various characteristics.
4. To conduct load test on three phases induction motor and plot various characteristics.
5. To study phenomenon of resonance in RLC series and parallel circuit and find the resonant frequency.
6. To calibrate single phase energy meter.
7. To measure strain of a specimen using strain gauge.
8. To study the operation and working of thermocouple pyrometer.

Reference Books:

1. Nagrath and Kothari: Electrical Machines, (TMH)
2. A.K. Sawhney: Electrical and Electronics Measurement and Instrumentation, Dhanpat Rai & Sons
4. Experiment sheets.

DEPARTMENT OF MECHANICAL ENGINEERING

Course Number and Title: ME-294 Machine Drawing and Computer Graphics

<table>
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<tr>
<th>Credits</th>
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<td>End Sem. Examination (2 hours) 40%</td>
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</table>

COURSE OBJECTIVES:

1. Conventions and symbols as per ISI recommendations.
2. Assembly and sub-assembly drawings of machines.
3. Model simple assemblies and sub-assemblies of machine parts.
4. Sharpen creative skills in developing new ideas.
5. Improve communication skills through technical drawings.

SYLLABUS:

Unit 1:

Fundamental Concepts and principles of Mechanics. Reduction of a system of forces to a force couple system, free body diagrams, equilibrium of rigid bodies in 3 dimensions, reactions, loading
indeterminacy and solvability. Friction forces and laws of dry friction. Principle and application of virtual work.

Unit 2:

Analysis of Multiple particle system: Application of Newton’s laws, linear and angular momentum, kinetic energy and work energy principle, principle of impulse and momentum to a system of particles.

Unit 3:

Translation and rotation about a fixed axis, general plane motion, absolute and relative velocity in plane motion, angular momentum of rigid body in plane motion. Problems of motion of rigid bodies and system of rigid bodies, principle of work and energy, conservation of energy for rigid body and a system of rigid bodies.

Unit 4:

Analysis of stress and strain: Mechanical properties, analysis of simple state of stress and strains, elastic constants, example of state of tension, compression and shear.

Unit 5:

Bending shear and torsion: Concept of bending and shear forces in simple beams, Relationship between loads, bending moment and shear force. Bending and shear stresses in simple beams, concepts of torsion in circular shafts.

Text Books:

Reference Books:
2. Timoshenko S. and Young DH, Elements of strength of materials, DYNC, New York.

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>AC-211 Engineering Chemistry &amp; Material Science</th>
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<td>Credits</td>
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<td>Course Category</td>
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<tr>
<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
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<td>Mid-Semester Examination (1 hour) (25%)</td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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</tbody>
</table>

DEPARTMENT OF APPLIED CHEMISTRY
COURSE OBJECTIVES
To impart knowledge about engineering materials their structure, treatment and characterization.

SYLLABUS:
Unit I: Crystal Structure of Engg. Materials:
Introduction: Scope of material science and classification of material Brief outlines of atomic bonding. Crystal structure: Periodicity in crystal, different types of structures–SC, BCC, FCC and HCP, Crystal system, crystal lattice, unit cell, crystal direction and crystal planes, miller indices, interplanar spacing, crystal defects, impact on the properties of Engineering Materials.

Unit II: Engg. Materials:
Introduction to engineering materials, classification, steels and cast irons, classification of steels, plain carbon steel, alloy steel, stainless steels, austenitic stainless steels, ferritic stainless steels, martensitic stainless steels, development of corrosion resistance in stainless steel, cast iron, gray cast iron, white cast iron, malleable cast iron, ductile cast iron.

Unit III: Phase Equilibria:
Phase rule, phase diagrams, phase changes in pure iron, binary systems, solid solution, different types of reaction involved in the binary system such as eutectic, eutectoid, peritectic and peritectoid. Binary phase diagrams: Pb-Sn, Cu-Zn, Fe-C.

Unit IV: Heat Treatment:
General principles, Types of heat treatment annealing, Normalizing, tempering, hardening, case hardening, au tempering, mar tempering, TTT Curves. Annealing, Normalizing, tempering, hardening, case is hardening, au tempering, and mar tempering TTT Curves.

Unit V: Characterization of Engineering Materials:
Characterization of microstructure using Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and its sample preparation techniques, XRD, TGA, DSC, DTA.

Unit – VI: Electrochemistry: Conductance and Ionic Reactions:

Text Books:
2. O.P. Khanna A Textbook of Materials Science and Metallurgy

Suggested Readings/Texts/References:
1. V. Raghavan.Materials Science and Engineering
2. B.K. Sharma Physical Chemistry
COURSE OBJECTIVES:
To make students aware about the basic concepts of thermodynamics and their application in solution Thermodynamics.

SYLLABUS:
Unit 1:

Unit 2:
Properties of Pure Substances, Changes to thermodynamics properties and their inter relationship, properties of single and two phase system, types of thermodynamic diagrams. Generalized Correlation for thermodynamic properties of gases. Multicomponent system: Partial molar properties, Chemical potential, fugacity and fugacity coefficients excess properties of mixture.

Unit 3:
Phase equilibrium system. V-L-equilibrium for miscible and immiscible system and their phase diagram, activity coefficients from experimental data.

Unit 4:
Reaction coordinates, chemical equilibria, application of the criteria for equilibrium to chemical reactions. Standard Gibb’s Free energy change and the equilibrium constant, temperature and pressure effects on equilibrium constant, calculation of equilibrium conversion for single and multiple reaction system.

Text Book:

Reference Books:
COURSE OBJECTIVES:

1. To develop an understanding of the basics of process instrumentation.
2. To gain an insight into the different types of instruments for measuring the important process variables.

SYLLABUS:

Unit 1: Introduction:

Unit 2: Elements of a measurement system:
Transducers/sensors-different types and principles, signal amplification, signal conditioning, signal filtering, signal transmission, I/O devices and displays, data acquisition and conversion.

Unit 3: Process Instruments:
Working principles of the instruments for the measurement of pressure, flow, vacuum, temperature, level, density, viscosity, and humidity etc

Unit 4: Other measurements:

Text Books:
Reference Books:


**DEPARTMENT OF CHEMICAL ENGINEERING**

<table>
<thead>
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<th>Course Number and Title</th>
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<td><strong>Contact Hours (L-T-P)</strong></td>
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<td><strong>Course Assessment</strong></td>
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<td>Mid-Semester Examination (1 hour) (25%)</td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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</table>

**COURSE OBJECTIVE:**

Integrates basic chemical engineering with a set of life sciences and biotechnology courses to transform basic resources into useful products (e.g. pharmaceuticals, plastics, renewable energy, energy storage) exploiting certain chemical and biological processes.

**SYLLABUS:**

**Unit 1:**


**Unit 2:**

Biopolymers: Basic concepts, classification of biopolymers, Lipids, Proteins, amino Acids, Nucleic Acids, carbohydrates.

**Unit 3:**

Unit 4:

Classification of micro organism, Influence of environmental parameters on micro organism. Applications of microorganism in various fields: agriculture, food, environment, medicine, public health and industry.

Text Book:


Reference Books:


Course Number and Title

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 226 Numerical Methods in Chemical Engineering</th>
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<td>End-Semester Examination (3 hour) (60%)</td>
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COURSE OBJECTIVES:

To provide knowledge of numerical methods and their applications to chemical engineering problems

SYLLABUS:

Unit 1:


Unit 2:

Solution of simultaneous linear equations by iterative methods. Solution of simultaneous nonlinear equations.
Unit 3:
Data analysis: interpolation and regression Numerical differentiation and integration.

Unit 4:
Solution of single and simultaneous ODE.

Text Book:
Balaguruswamy E., Numerical Methods, Tata McGraw Hill

Reference Books:
3. Ghosh P., Numerical Methods with Computer Programs in C++, PHI
5. Courdin A. Bourmahrat, M. Applied Numerical Methods, PHI
8. Gupta S.K., Numerical Methods for Engineers, New Age International (P) Ltd New Delhi

DEPARTMENT OF ENGLISH

<table>
<thead>
<tr>
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<th>EZ 291 CH 292 Communication Skills Lab-I</th>
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<td>Laboratory Course</td>
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<td>40 Marks</td>
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COURSE OBJECTIVES:
To develop communication and presentation skills using modern tools.

COURSE OUTCOMES:
Upon successful completion of this course, it is expected that students will be able to:

1. Analyze and apply the basic concepts of communication effectively.
2. Develop written and spoken communication skills.
3. Able to present their ideas rationally and logically.

4. Use modern communication tools for effective communication and presentation.

5. Describe the importance of constructive feedback for consistent self-development.

6. Communicate one's point of view with clarity duly attributing courtesy and formality to their conveying.

7. Engage in debates, group discussions and personal interviews.

8. Deliver oral presentation and seminars confidently.

**Course Syllabus:**

**Unit I.**
Writing Official Letters: Basic principles, format and type: employment letters, placing orders enquiry and response letters, letters of complaint and apology, persuasive letters, curriculum vitae.

**Unit II.**
Business Working:
   (a) Glossary of business terms
   (b) Drafting business messages: memos, telexes, e-mails, press notice references, tenders and bids, employment advertisements.

**Unit III.**
Academic Writing:
   (a) Note-making and note-taking, abstracting, use of graphics (tables and free diagrams) preparing bibliography.
   (b) Writing academic papers and reports

**Unit IV.**
Oral Communication in Business Setup: Attending interviews, telephonic conversation, reception of visitors, holding meetings.

**Unit V.**
Oral Communication in Academic Setup: Participating in group discussions, Presenting prepared papers and reports, Seminar Strategies.
Course Objectives:
The course is designed so that the chemical engineering students get familiarized and become well versed with the various fluid flow phenomena, fluid flow measurement, fluid particle operations, and size reduction in chemical industries.

List of Problems:

1. Flow through circular pipes
2. Flow through an annulus
3. Characteristics of flow through coils. (Helical and Spiral)
5. Verification of Bernoulli’s Theorem
6. Capillary flow viscometer.
7. Orifice meter and Venturimeter.
8. Velocity profile using Pitot tube
9. Efflux time of tanks
10. Characteristics of centrifugal pumps
11. Grinding Characteristics of Crushing Machines
12. Breakage and Selection Function
13. Elutriation and Particle Size Distribution
15. Plate and Frame Filter Press
16. Screening through compound Trommel at different speed and angle of inclination
17. Bucket and belt conveyors.
18. Variable speed Ball Mill
19. Flow through Fluidized Bed
Reference Books:


**DEPARTMENT OF CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 312: Heat Transfer Operations</th>
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<td>Credits</td>
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<td>Mid-Semester Examination (1 hour) (25%)</td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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</table>

**Course Objective:**
To provide the basic knowledge of heat transfer processes used in chemical Industries.

**Course Syllabus:**

**Unit 1:**
Fundamental laws of heat transfer, conduction through single and composite layer, concept of film resistance and thermal boundary layer, concept of heat transfer coefficient and its prediction
Mechanism of heat transfer in forced and free convection. Empirical correlation for estimating heat transfer coefficient in various conditions Insulation material, cold and hot insulation material thickness calculation for insulating material Heat transfer fluids

**Unit 2:**
Boiling: Boiling Characteristics, Nucleate pool Boiling and Force convection boiling. Boiling mechanism boiling curve and heat transfer correlation Heat pipe
Condensation: Mechanism and type of condensation of vapours, Nusselt equation for film wise condensation on vertical surface, inclined and horizontal surface ,condensation Number, film condensation inside horizontal tubes
Evaporators: classification and use of Evaporators in process industries effect of boiling point elevation and hydrostatic head on evaporator performance estimation of surface area in multiple effect evaporator calculation in process industries, fouling in evaporator

**Unit 3**
Heat Exchangers: Importance of heat exchanger in process industries various types of heat exchange devices and their selection double pipe and shell and tube heat exchanger design and rating calculation Ft correction factor, Liquid gas liquid and gas system Concept of effectiveness and NTU of heat exchanger Extended surface for heat Transfer
Unit 4:
Heat transfer in agitated vessel Heat transfer to fixed and fluidized bed Radiative heat transfer basic laws black body and gray body radiation view factor Radiation in gases and vapours

**Text Book**


**Reference Book(s)**


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**DEPARTMENT OF CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 313, Mass Transfer Operations</th>
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<td><strong>Credits</strong></td>
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<td><strong>Course Category</strong></td>
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<td>CH 211, AM 241</td>
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<td><strong>Contact Hours (L-T-P)</strong></td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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**COURSE OBJECTIVES:**

To enable the students to learn the basics of mass transfer operations used in process industries and to design the equipment used for gas absorption, humidification, drying and crystallization operations

**Course Syllabus:**

**Unit 1. General Introduction:**

Mass transfer operations and its classifications, Diffusion mass transfer, Mass transfer coefficient, Mass transfer models, Mass transfer with reactions.

**Unit 2. Gas Absorption Operations:**

Equilibrium, Choice of solvents, Co-current and counter current operations, packed bed and staged columns.
**Unit 3. Humidification Operations:**
Psychometric, Adiabatic humidification and dehumidification operations, Humidification equipments

**Unit 4.**
(a) **Drying Operations:** Fundamentals, Drying curve, Equipment for drying.
(b) **Crystallization Operations:** Basic principles and fundamentals, industrially important crystallizers.

**Text Book:**

**Reference Books:**

**DEPARTMENT OF CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 314, Chemical Reaction Engineering</th>
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<td>End-Semester Examination (3 hour) (60%)</td>
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**COURSE OBJECTIVE:**
Application of Stoichiometry, Material & Energy Balances, Thermodynamics, and Mathematical Analysis to understand the basic principles of Kinetics and Chemical Reaction Engineering. Utilizing this knowledge in the interpretation of kinetic data, and Analysis & Design of Chemical Reactors.

**SYLLABUS:**

**Unit 1.**

**Unit 2.**
Multiple Reactions: parallel and series reactions, contacting pattern and product distribution, series-parallel reactions in mixed and plug flow reactors, optimum yield of desired product. Temperature and pressure effects on equilibrium conversion, exothermic and endothermic reactions, optimum temperature progression

**Unit 3.**
Residence Time Distribution: state of aggregation and mixing of fluids, stimulus response techniques, the RTD, E and F curves, RTD for ideal reactors, conversion in non-ideal reactors. Non-ideal flow models.

**Unit 4.**

**Text Books:**


**Reference Books:**


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**Course Objectives:**

To learn Material & Energy Balances, Detail Study of separation process such as Distillation, Liquid Liquid extraction, Leaching, Adsorption etc, frequently encountered in chemical industries.

**Syllabus:**

**Unit 1.**


**Unit 2.**

Distillation column: Types of trays, reboiler condenser, Efficiencies.

**Unit 3.**

Multicomponent Distillation: Light key-heavy key components stage to stage calculation, Introduction to Thele Geddes and Lewis Matheson Method.

**Unit 4.**

(a) Liquid-Liquid Extraction: Graphical representation of ter. Component, single stage multistage extraction crosses current, counter current extraction with and without reflux. Extraction Equipment.

(b) Solid-liquid Extraction: Equilibrium data and curve. Cross current and counter current leaching, no. of stages by graphical and analytical method, Leaching Equipments.

**Unit 5.**

Text Book:
Gean Kopolis, Transport Processes and Unit Operations, Prentice Hall of India.

Reference Books:
1. Foust, et al., Principles of Unit Operation’s John Wiley and Sons, N.Y.

DEPARTMENT OF CHEMICAL ENGINEERING

<table>
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<tr>
<th>Course Number and Title</th>
<th>CH 381, Seminar and Report Writing</th>
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COURSE OBJECTIVE:
1. Get an opportunity to read study and understand articles published in the literature.
2. Awareness about emerging trends in chemical engineering and allied industries.
4. Acquire good oral and written communication skills.
5. Compile and write technical reports.
6. Analyse contemporary issues.

**COURSE DESCRIPTION:**

This practical / seminar course is focused on student’s employability skills, such as communication, both soft and written. It also covers new developments / contents beyond syllabus.

**Principles of Literature Searching.** Primary and secondary sources of information, patent literature. Translation, abstracting and indexing journals, reference books, bibliographies: Selective chemical engineering literature. Standard government and trade publications.


**Seminar:** The faculty incharge of the course will identify and allot seminar topics to the students in the emerging areas of chemical engineering / process engineering that are not covered in the regular courses. The student will be required to collect information relating to the allotted topic from the library (Journals, periodicals, magazines), research organizations and chemical industry and submit a comprehensive technical report in a uniform format. He shall also present the topic orally to a gathering of staff and students using multimedia / lecture aids. Each student is also supposed to deliver another seminar on a topic other than the Seminar Report.

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**DEPARTMENT OF CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 391Computer Application Lab II</th>
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<td><strong>Total</strong> 40 Marks</td>
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<td><strong>Grand Total</strong> 100 Marks</td>
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</table>

**COURSE OBJECTIVES:**

To develop the hardware acumen and programming language.
List of Experiments (Computational):

1. Brief description of computer hardware and PC Configuration
2. Brief overview of C/C++/FORTRAN language
3. Review of Numerical Methods
4. Roots of non-linear equation (Bracketing methods)
5. Roots of non-linear equation (Non-Bracketing methods)
6. Simultaneous linear equation
   - Direct and
   - Iterative methods
7. Data Analysis
   - Interpolation
   - Regression
8. Numerical Differentiation and integration
9. Ordinary differential Equation
10. File Handling Data retrieving and storage

Textbook(s)/ Reference Book(s):


DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 320 CHEMICAL PROCESS INDUSTRIES – I</th>
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<td>End-Semester Examination (3 hour) (60%)</td>
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</tbody>
</table>
**COURSE OBJECTIVES:**

To make aware about latest technological development availability of raw materials, production trends, preparation of flow sheets, engineering and environmental problems, energy consumption and economic status of various chemical industries.

**SYLLABUS:**

**Unit 1:**
Industrial Acids, Bases and Gases: Sulphur and Sulphuric Acid, Nitric Acid, ‘P’ and Phosphoric Acid, Acetic Acid, HCl, H₂ (Hydrogen) Caustic soda, Soda Ash, Cl₂

**Unit 2:**
Fertilizers and Pesticides: Nitrogenous, Phosphatic, Potash, mixed complex and bio fertilizers, pesticides

**Unit 3:**
Cement and Silicate Industry: Cement, Glasses and Ceramics.

**Unit 4:**
Miscellaneous: Paints, Dyes, and Starch.

**Text Book:**


**Reference Books:**

1. Ullman’s Encyclopedia of Industrial Chemistry
2. Faith, Keys and Clarks, Industrial Chemicals, Wiley Inter Science.
5. Venkateswarlu, S. (Ed.) CHEMTECH( I-IV) Chemical Engineering Development Centre, IIT, Madras
7. F.A.Henglein Chemical Technology Pergamon Press NY
COURSE OBJECTIVES:
A study the chemical industries in relation to their current status, production and consumption pattern, manufacturing process, latest technologies development, engineering problem viz. pollution control, material of construction, corrosion, kinetic aspects, energy consumption and economic status.

SYLLABUS:
1. Industrial chemical: BTX, Alcohol, Acetone, Aldehyde, Aniline, Phenol, Ethylene Oxide, Ethylene Glycol and Nitrobenzene.
2. Introduction to natural and synthetic rubber and their production: Production of various thermo and thermosetting plastics. Natural and synthetic fibers, pulp and paper.
3. Extraction of edible oil, fat splitting, Hydrogenation of oil, soap and detergent, production of glycerine.
4. Petroleum its classification and product; Primary and secondary refining processes.

Text Book:

Reference Books:
2. Faith, Keys and Clarks, Industrial Chemicals, Wiley Inter Science.
3. Henglein, Chemical Technology, Pergaman Press.
Course Objective:

To provide a sufficient background to be able to understand the fundamental principles of momentum, heat and mass transfer, governing equations (conservation and constitutive equations) and assumptions used in the analysis of transport processes. Develop physical understanding of, and the ability to apply these principles

Syllabus:

Unit 1.
General introduction to Transport Process. Equation of continuity and equation of change. Steady Flow of incompressible fluids in conduits and thin layers, Flow of falling film, flow between parallel plates, flow through circular pipes and annulus, adjacent flow of two immiscible fluids etc.

Unit 2.
Analysis of Thermal Transport Process: Fourier’s law of Heat Conduction, steady one dimensional heat conduction without and with internal heat Source, Conduction through plane wall, hollow cylinder, composite walls and multilayer tubes, critical thickness of insulation.

Unit 3.
Analysis of Species Transport Processes: equation of continuity and change for multicomponent system. Definition of concentrations, velocities and fluxes in multi species system, Fick’s Law of diffusion .the continuity equation for binary systems. Transport of species through stagnant and counter diffusing phase.

Unit 4.

Text Book:

Reference Books:


**DEPARTMENT OF CHEMICAL ENGINEERING**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 324 PROCESS EQUIPMENT DESIGN</th>
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<td>Course Category</td>
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<td>Pre-requisite(s)</td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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</table>

**Course Objectives:**

To provide knowledge about design principles of heat and mass transfer equipment used in chemical plants.

**Syllabus:**

**Unit 1.**

Detailed process design of the following heat transfer equipments : Heat exchangers -, Shell and Tube heat exchangers. Plate Heat Exchanger

**Unit 2.**

Design of condensers for single vapour’s, heat transfer coefficient correlations for condensation inside and outside of tubes of the vertical and horizontal condensers, design of desuper heater-cum-condenser and condenser-cum-sub-cooler, condensation of mixtures, pressure drop in condensers Reboilers, vaporizers and evaporators selection of reboilers, and vaporizers, design of reboilers, vaporizers and evaporators, drawing of evaporators.
Unit 3.

Detailed Process design of the following mass transfer equipment’s: Absorption towers - plate tower and packed tower absorption columns. Distillation towers - plate tower and packed tower distillation columns.

Unit 4.

Design of Crystallizers, Agitated vessels and selection of agitators, design of gas- liquid separators and mixing equipment. Extractor, Design of PFR and CSTR

Text Books:


Reference Books:

2. Dawande Process Equipment Design Central Technical Publications Nagpur

NOTE: This is an OPEN BOOK EXAMINATION. The students are allowed to consult IS Codes, Text books, Reference

DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 335 Bioprocess Engineering</th>
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<td>Credits</td>
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<td>End-Semester Examination (3 hour) (60%)</td>
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Course Objectives:
To get an understanding of the basics of Bioprocess Engineering. To gain an insight in various state of art technologies for bioprocesses and its application in Biotechnological Industries.
Syllabus:

Unit 1. Scope of Bioprocesses:

Formulation of medium, Measurement of growth, Typical batch growth curve, Monod’s equation, Classification of bioprocesses, Growth associated and non-growth associated products, Discovery of Penicillin and future prospects of bioprocess engineering.

Unit 2. Enzyme catalysed reactions:
Characteristics of an enzyme, Michaelis-Menten equation, the various parameters affecting the enzyme catalysed reactions, Line Weaver- Bulk Plot, Experimental determination of $K_m$.

Competitive and non competitive inhibition and their effects at the rate of reaction. The free cells and enzymes, Immobilization of cells and enzymes. Diffusional limitations in immobilized cells and Bioreactors for immobilized cells systems.

Unit 3. Design of Bioreactors:
The important parameters of design, The methods of sterilization for air and medium at laboratory and industrial scales, Heat and mass transfer to bioreactors, The various bioreactors (CSTR, Bubble column and plug flow reactor) used in industries, The wash out phenomena, The aseptic sampling and instrumentation of bioprocesses.

Methods for animal cell cultivation and products of animal cell culture, enzymes, insecticides, & whole cells. The tissue culture, Plant Cell Culture; Method of production, active and passive methods (Encapsulation, Covalent bonding, & Precipitation of polymers).

Unit 4. Industrial production/ Downstream Processing:
The production of ethanol, solvent, acid, Vitamin, and antibiotic. The down stream processing (separation of microbial cell and the product), Significance of downstream processing, strategy to recover extra cellular and intra cellular products and to purify them. Separation of insoluble products Separation of soluble products; Precipitation, Adsorption, Dialysis, R.O., UF and MF.

Cell disruption Finishing operations in bioprocess industries. The waste water characteristics of bioprocess industries and their proper disposal.

Text Book

Reference Books


DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 392 Chemical Engineering Design</th>
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Course Objectives
To develop the skills for applying the knowledge of chemical engineering courses in the design of equipment’s.

Syllabus:
Mechanical design and drawing of the following chemical equipment

1. Shell and Tube heat exchangers
2. Evaporators and crystallizers
3. Distillation and Absorption Columns
4. Reactors
5. Storage tanks- horizontal, vertical and spherical

Textbook(s)/ Reference Book(s)


Reference Books

Course objectives:

1. To enable the students to learn the theoretical concepts of heat and mass transfer through experiments
2. To give the students a better understanding of the heat and mass transfer equipment
3. To enable the students to work as a team and improve their communication skill through viva voce on a regular basis

Syllabus:

Experiments on the following topics of heat and mass transfer

1. Natural Convection
2. Boiling Heat Transfer
3. Film and Drop wise Condensation
4. Open Pan Evaporator
5. Double Pipe Heat Exchanger
6. Shell and Tube Heat Exchanger
7. Steam Distillation
8. Differential Distillation
9. Liquid-Liquid Equilibria
10. Liquid-Liquid Extraction
11. Solid Liquid Extraction
12. Batch Drying
13. Cooling Transfer
14. Solid Dissolution

Reference Books:


**Department of Chemical Engineering**

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 394 Reaction Engg. &amp; Thermodynamics Lab</th>
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<td>Grand Total 100 Marks</td>
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**Course Objectives:**

1. Understand the significance of reaction rate constant & the role of catalyst in chemical reactions.
2. Know the objective of multiple reactor system.
3. Feel the importance of working in a group.
4. Write technical reports on their own.
5. Learn safe working procedures and a sense of responsibility and punctuality.

**Syllabus:**

**List of Experiments**

1. Determine the Residence Time Distribution and plot RTD curve in a single CSTR. Find the MRT for a given flow rate. Use a 5N NaOH solution as tracer.

2. Determine the Residence Time Distribution and plot the RTD curve for a Tubular vessel. Find the MRT for a given flow rate. Use a 5N NaOH solution as tracer.

3. Determine the Residence Time Distribution and plot the RTD curve for a system of series of 3 CSTRs. Find the MRT for a given flow rate. Use a 5N NaOH solution as tracer.

4. Study the kinetics of saponification reaction between acetic acid and sodium hydroxide in a batch reactor and establish the rate law.

5. Determine the partial molar volume of a binary liquid mixture (ethanol-water) at the ambient conditions as a function of concentration.
6. Kinetic study of a non-catalytic homogeneous liquid-phase second-order reaction in a CSTR: Determine the reaction rate constant for the saponification of ethyl acetate with sodium hydroxide.

7. Kinetic study of a non-catalytic homogeneous liquid-phase second-order reaction in a plug flow reactor: Determine the reaction rate constant for the saponification of ethyl acetate with sodium hydroxide.

8. Kinetic study of a non-catalytic homogeneous liquid-phase second-order reaction in a batch reactor: Determine the reaction rate constant for the saponification of ethyl acetate with sodium hydroxide.

Reference Books:


Course Number and Title

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 410 Energy Engineering and Management</th>
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<tr>
<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
</tr>
<tr>
<td></td>
<td>Mid-Semester Examination (1 hour) (25%)</td>
</tr>
<tr>
<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
</tr>
</tbody>
</table>

Course Objectives:

1. To develop an understanding of the basics of energy.
2. To gain an insight into the different sources of energy and their utilization in process industry.
3. To have an understanding of energy management principles.

Syllabus:

Unit 1.

Various Energy resources, consumption pattern, future sources of energy, and energy resources position in India. Classification of fuels, fuel calorimetry, transport, storage, safety and environmental aspects of energy use.
Unit 2.
Solid, liquid and gaseous fuels: classification, analysis and various uses. General features of combustion equipment employed in chemical industry.

Unit 3.
Biomass resource, chemical, thermo-chemical and biochemical conversion of biomass. Alternate fuels and fuel cells. Energy storage routes like thermal energy storage, chemical, mechanical storage, electrical storage.

Unit 4.

Unit 5.

Text Books:

Reference Books
Course Objectives:

To develop the skills for analyzing the process under transient condition and devise the controlling strategy to attain the desired operation. Role of digital computer in process control must also be understood.

Syllabus:

Unit 1.


Unit 2.

Analysis of first order systems with different forcing functions, Analysis of second and higher order systems, components of a feed back control system Modes of Control Action: Controllers and final Control Elements, Closed loop transfer function, block diagram algebra.

Unit 3.

Stability of control systems, Controller tuning, Frequency Response Analysis, Bode diagrams, Bode diagrams for first and second order systems, P, PI, PID controllers, transportation lag. Nyquist plot, phase margin and gain margin, Nyquist stability criteria.

Unit 4.


Textbook(s):


Reference Book(s):


DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH-415 Process Engineering and Plant Design I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>04</td>
</tr>
<tr>
<td>Course Category</td>
<td>Departmental Core (DC)</td>
</tr>
<tr>
<td>Pre-requisite(s)</td>
<td>Nil</td>
</tr>
<tr>
<td>Contact Hours (L-T-P)</td>
<td>3-1-0</td>
</tr>
<tr>
<td>Type of Course</td>
<td>Theory</td>
</tr>
<tr>
<td>Course Assessment</td>
<td>Course Work (Home assignments, tutorials and quizzes) (15%)</td>
</tr>
<tr>
<td></td>
<td>Mid-Semester Examination (1 hour) (25%)</td>
</tr>
<tr>
<td></td>
<td>End-Semester Examination (3 hour) (60%)</td>
</tr>
</tbody>
</table>

Course Objective:

The course presents systematic tools for developing and screening potential process flow sheets.

Syllabus:

Unit 1.

Introduction to process plant design and an overview of a typical chemical plant. The hierarchy of process design and the onion model. Principles and approaches to process synthesis, choice of reactors, choice of separators, reaction path synthesis.

Unit 2.

Synthesis of reaction-separation systems, separation task selection and integration, Distillation sequencing, Heat Exchanger network and pinch analysis.

Unit 3.

Process engineering, structure and analysis of systems with respect to design variables and design equations, degree of freedom in a system, design variable selection. Algorithm for simple and recycle systems, analysis of some typical separation operation elements and units, enumeration algorithm for combination of elements to form units, analysis of complex process units.

Unit 4.

Text Book:


Reference Books:


DEPARTMENT OF CHEMICAL ENGINEERING

Course Number and Title | CH 442 PETROLEUM PROCESSING
---|---
Credits | 04
Course Category | Departmental Elective -II(DE-II)
Pre-requisite(s) | Nil
Contact Hours (L-T-P) | 3-1-0
Type of Course | Theory
Course Assessment | Course Work (Home assignments, tutorials and quizzes) (15%)  
Mid-Semester Examination (1 hour) (25%)  
End-Semester Examination (3 hour) (60%)

Course Objectives:

At the end of the semester the student should be able to:

1. To provide a broad technical information on refining processes and petroleum products.
2. To learn about composition, main characteristics and new trends of petroleum products.
3. To grasp the role of various processing units in a general modern Indian refinery.
4. To describe the main manufacturing schemes encountered in oil refining.
5. To learn various techniques for converting waste into wealth.

Syllabus:

Unit 1.

Indian refining industry and refining trends, crude: their properties, composition and classification, refining products: production, properties and standard testing methods. Overview of a refinery.
Unit 2.
Crude oil distillation: pre-treatment of crude, heating of crude, atmospheric and vacuum distillation. Treatment processes: acid and alkali treatment, clay and bauxite treatment, sulphur removal and sweetening processes, solvent extraction process.

Unit 3.
Thermal cracking processes, visbreaking and delayed coking, catalytic cracking processes, catalytic cracking, reforming and hydrocracking.

Unit 4.
Light ends management: polymerization, alkylation and isomerization, speciality products: lubricating oil (lube oils), resins, bitumen, product blending.

Text Book:

Reference Books:
4. Ram Prasad,
functions, user defined functions, visual basic editor, Nonlinear functions and its solutions technique, Goal Seek and solver.

**Unit 2.**
Solution of simultaneous linear equation, data analysis, Differential equation, simulation of double pipe heat exchanger, Optimization on Excel: linear and non linear Optimization, MILP, MIP Simulation on Excel: specific problems, ADI for solution of PDE

**Unit 3.**
MATLAB introduction, array, matrix and vector manipulation, MATLAB programming, linear and non linear equations, curve fitting data analysis, differentiation, integration and differential equation, work space handling, graphics, simulation of specific problems through MATLAB.

**Unit 4.**
Simulink basics, library function, model building, simulation of models, presentation of result graphical and workspace, State Space modelling and Simulation. Modular approach to process simulation, sequential and simultaneous modular, incidence matrix, digraph, associated adjacency matrix, path tracing method, tearing system of equations, SWS algorithm, matrix inversion by block methods, signal flow graph, Tearing algorithm of networks, Chemical engineering simulation packages.

**Textbook(s)/ Reference Book(s):**


Course Objectives:

To get an understanding of the basics of solid waste management. To gain an insight in various state of art technologies and its application in solid waste management.

Course Syllabus:

Unit 1.

Unit 2.

Unit 3.

Unit 4.

Biochemical Conversion Technologies: Nutritional Requirements, Types of microbial Metabolism, Aerobic Biological transformations, Anaerobic Biological transformations.

Textbook:
Reference Book(s):

DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 491 CAD/Simulation Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>02</td>
</tr>
<tr>
<td>Course Category</td>
<td>Departmental Core (DC)</td>
</tr>
<tr>
<td>Pre-requisite(s)</td>
<td>Nil</td>
</tr>
<tr>
<td>Contact Hours (L-T-P)</td>
<td>0-1-2</td>
</tr>
<tr>
<td>Type of Course</td>
<td>Laboratory Course</td>
</tr>
<tr>
<td>Course Assessment</td>
<td>Report Preparation and Submission 40 Marks</td>
</tr>
<tr>
<td></td>
<td>Viva-voce 20 Marks</td>
</tr>
<tr>
<td></td>
<td>Sessional 60 Marks</td>
</tr>
<tr>
<td></td>
<td>End Semester Examination: Viva-voce and/or Practical 40 Marks</td>
</tr>
<tr>
<td></td>
<td>Grand Total 100 Marks</td>
</tr>
</tbody>
</table>

Course Objective:
To make the students aware to use the commercial simulation and other software in the simulation and design of chemical engineering equipment’s

Syllabus:
Use of Commercial Process Simulator in:

1. Thermo physical properties of pure components and mixture
2. Single stage Flash Calculation
3. Short cut Method for distillation column
4. Simulation and sizing of reactor, Absorber and Heat Exchanger
5. Crude Oil Assay
6. Solution of non-linear equations, data analysis and ODE using MS Excel and MATLAB

Reference Books

1. Bruce A. Finlayson, Introduction to Chemical Engineering Computing, John Wiley & Sons
Syllabus:

List of Experiments

1. Essential Oils Extraction
2. Dehydration of Vegetables
3. Solvent Extraction of Edible Oil
4. Preparation of Soya Milk
5. Milk Testing
6. Analysis of Detergent
7. Adsorption Isotherm
8. Analysis of Cement
9. Decaffeination of Tea
10. Egg Oil Extraction
11. Formulation of Adhesive
12. Paint Testing
13. Formulation of Disinfectants
14. Fermentation of Sugar
15. Preparation of Polymer Resin

Reference Books

2. INSTRUCTION AND SHEET/LAB MANUAL
DEPARTMENT OF CHEMICAL ENGINEERING

Course Syllabus:

During the course of study each student is expected to undertake a total of four weeks of training in industry /institutions.

Textbook(s)/ Reference Book(s):  Nil

Course Objectives:

Students should have an ability to apply the knowledge gained through all the courses of chemical engineering programme while preparing the comprehensive techno-economic feasibility report on the design of a selected industrial chemical plant.

Syllabus:

In this project students are supposed to make techno economic feasibility report on the particular plant design project finalized by the teachers. The topics of this plant design project are decided on the basis of its economic viability and industrial importance. At the end of the session they do compile and submit a report in bound form.

No. of students per project: 4-6
Course Objectives:
Students should have an ability to develop different types of models for various chemical engineering systems along with the knowledge of suitable simulation and optimization techniques.

Syllabus:

Unit 1.
Introduction to process modelling and simulation, models, need of models and their classification, models based on transport phenomena principles, alternate classification of models, population balance, stochastic, and empirical models.

Unit 2.
Modelling and simulation of heat and mass transfer operations, development of mathematical model and its solution for heat exchangers, multiple effect evaporator, distillation column, absorption tower and extractor.

Unit 3.
Modelling and simulation of reactors. Process optimization, one variable optimization

Unit 4.
Unconstrained and constrained optimization of multivariable objective functions, Linear programming.

Text Books

Reference Books

**Course Objectives:**

Students should have an ability to learn various common aspects required in the design of a process plant or one or more of its components, e.g. economic, safety, health, social and legal considerations.

**Syllabus:**

**Unit 1.**


**Unit 2.**

Role of process economics in design of process plant and simple economic criteria. Types of cost estimation: capital cost for new and retrofit design, annualized capital cost, operating cost, battery limit investment, process equipment cost estimation, taxes and depreciation cost. Project cash flow and economic evaluation.

**Unit 3.**

General and industrial aspect of safety, Safety education and training, fundamentals of safety tenets and general safety rules, safety management and measuring safety performance, safety protection.
equipment, safety and site selection, safety and health consideration, legal aspects of industrial safety, safety audit, OSHA.

**Unit 4.**


**Text Books**


**Reference Books**

Course Objectives:
To get an understanding of the basics of Industrial Pollution. To gain an insight in various state of the art technologies and its application in waste management.

Syllabus:

Unit 1.
Introduction: Environment and types of pollutants and their effect on environment. Environmental pollution from chemical process industries, characterization of waste, environmental laws and standards for ambient air, noise emission and water pollutants.

Unit 2.
Air Pollution Control: Particulate emission control by mechanical separation and electrostatic precipitation, wet gas scrubbing, gaseous emission control by adsorption and absorption, Design of cyclones, ESP, fabric filters and absorbers

Unit 3.
Water Pollution Control: Pre-treatment, solids removal by setting and sedimentation, filtration centrifugation, coagulation and flocculation. Chemical Treatment: Anaerobic and aerobic treatment biochemical kinetics, trickling filter, activated sludge and lagoons, aeration systems, sludge separation and drying.

Unit 4.

Reference Books:
1. Peavy, H. S., D. R. Rowe, G. Tchobanoglous “Environmental Engineering”, McGraw Hill,
2. Pollution Control Acts, Rules and Notifications, CPCB, Delhi. 1995
Course Objectives:

To get better understanding of the basics and applied parts of transfer of heat in process industries. To gain an insight in various state of art technologies and its application in Indian chemical industries with respect to energy conservation and management.

Syllabus:

Unit 1.

Unit 2.
Various types of Heat Exchanger, Design of Heat Exchanger (Kern and Bell’s Method), Selection of Industrial Heat Exchanger, Compact Heat Exchanger (Plate and Frame, Finned etc.), Evaporation, Types of feed, Types of Evaporators and design of Evaporator.

Unit 3:
Boiling and Condensation (Change of Phase) Heat Transfer, Boiling Curve, Mechanism of Boiling, Enhancement Techniques for boiling and condensation, and Correlations for Calculation of their Heat Transfer Coefficients.
Unit 4:
Heat transfer Studies in Packed and Fluidized Beds (calculation of Pressure drop and heat transfer coefficient), and other miscellaneous topics.

Text Book:

Reference Books:

DEPARTMENT OF CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>CH 493 Process Control &amp; Instrumentation Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>02</td>
</tr>
<tr>
<td>Course Category</td>
<td>Departmental Core (DC)</td>
</tr>
<tr>
<td>Pre-requisite(s)</td>
<td>CH 411</td>
</tr>
<tr>
<td>Contact Hours (L-T-P)</td>
<td>0-1-2</td>
</tr>
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<td></td>
<td>Quiz 15 Marks</td>
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<td></td>
<td>Grand Total 100 Marks</td>
</tr>
</tbody>
</table>

Course Objectives:
To develop the skills for the design of experiments to analyze the process under transient condition and characterizing the control parameter.

Syllabus (List of Experiments):
1. Calibration of Pressure Gauge
2. Dynamics of Thermometer

3. Dynamics of Thermal System

4. Dynamics of Evacuation system

5. Dynamics of liquid level system

6. Control of liquid level system

7. Dynamics and Control of Heat Exchanger

**Textbook(s)/ Reference Book(s):**


ORDINANCES AND REGULATIONS
1. Introduction

(a) The Faculty of Engineering & Technology, Aligarh Muslim University offers full-time program leading to the Bachelor of Technology (B. Tech.) degree in Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Electronics Engineering, Mechanical Engineering, and Petrochemical Engineering.

(b) The medium of instruction in B. Tech. Program is English.

2. Eligibility

A candidate will be eligible for admission to B. Tech. program if he/she has passed the Senior Secondary School Certificate (10+2) Examination of this University or an Examination recognized by this University as its equivalent with 50% marks in aggregate of English, Physics, Chemistry, and Mathematics, or have passed the Diploma in Engineering Examination of this University with 50% marks in aggregate.

3. Admission

(a) The admissions to the B. Tech. programs will be made normally in the Autumn Semester as per the admission policy approved by the Academic Council of the University from time to time. The admission of each student will be made in a particular branch.

(b) A limited number of students may be allowed to change over from one branch of study to another, after first year of study, depending on the availability of seats and their performance in the first two semesters.

4. Academic Session

The academic session is divided into two regular semesters – autumn and Winter, each of which shall be have approximately 20 weeks duration. The autumn semester will normally commence in the month of July/August every year, and the winter in the month of December/January. In the beginning of every session the Dean, in consultation with the Chairmen of the departments concerned, shall notify a detailed academic calendar indicating the schedule of teaching, examination, and other activities.

5. Duration of the Program

5.1 Minimum Duration

The minimum duration of the program shall be eight consecutive semesters after admission.

5.2 Maximum Duration

The maximum duration of the program shall be fourteen consecutive semesters after admission.
6. Curriculum and Credit System

6.1 Credit System

Each B. Tech. program will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week, as given below:

- 1 Lecture period (L) per week = 1 Credit
- 1 Tutorial period (T) per week = 1 Credit
- 1 Practical period (P) per week = 0.5 Credit

In addition to theory and laboratory courses there may be other courses such as seminar, colloquium, project, etc., which will be assigned credits as per their contribution in the program without regard to contact periods.

6.2 Course Categories

The curriculum for each branch will contain courses in the following categories having credits in the ranges given below in such a way that the total of all credits will be equal to that required for the award of degree as specified elsewhere in these ordinances.

(a) Basic Sciences (BS) = 20-36 credits
   (Courses such as Physics, Chemistry, Mathematics etc.)

(b) Engineering Sciences & Arts (ESA) = 20-40 credits
   (Foundation and applied engineering courses that are used across many branches)

(c) Humanities and Management (HM) = 10-18 credits
   (Language, Social science, & Management)

(d) Departmental Core (DC) = 60-116 credits

(e) Departmental Electives (DE) = 16-32 credits

(f) Open Electives (OE) = 8-16 credits

6.3 Coordinators and Curriculum Development Committee

There shall be a Chief Coordinator, B. Tech. Programs, to be nominated by the Dean, and a Coordinator, B. Tech. Program for each branch in each department, to be nominated by the Chairman of the department concerned. Normally the Chief Tabulator will be the Chief Coordinator, B.Tech. Programs. There shall also be a standing Curriculum Development Committee (CDC), to be constituted by the Faculty. The Chief Coordinator, B. Tech. Programs will be the Convener of the CDC.

6.4 The Curriculum Structure

The curriculum for each branch will contain a listing of all courses, with each course having a course category, course number, course title, number of contact periods per week, number of credits assigned, and the marks assigned to various components of evaluation. It
will also have a list of alternative courses in the new curriculum for the old curriculum courses and filler courses to compensate for the shortfall in credits earned by taking alternative courses in any category, if needed. It will also specify all other conditions required for the award of degree.

6.5 Approval of the Curriculum

The curriculum for each branch of B. Tech. program will be prepared by the department concerned and will be approved by the Board of Studies of the department. It will then be vetted by the CDC and will then be placed in the Faculty along with the recommendations of the CDC for approval. Once approved by the Faculty, the Curriculum will be implemented. The same procedure shall be used for any modification in the Curriculum.

7. Registration

7.1 Registration Procedure and Schedule

(a) Every student is required to register, in each semester, for the courses that he/she wants to pursue in that semester. The registration schedule will be announced by the Dean/Chairman for every semester. The registration process involves:

   i. Submitting a registration form in the office of the Chairman and obtaining a registration card signed by the Chairman;
   ii. Paying the required fees.

(b) A student will normally register for higher semester courses only if he has also registered for uncleared courses of previous semesters, especially in the case of uncleared courses of first two semesters.

(c) A student will have the option to add/delete/alter the courses in his/her registration within a week of the registration subject to such conditions as may be imposed by the department concerned from time to time.

(d) A student can drop a course from his/her registration by submitting a request to his/her department coordinator up to a date specified on his/her registration card. A registered course will be counted as an attempt even if the student remains absent in the Examination(s).

(e) No student will be allowed to register for more than 40 credits in a semester. A graduating course, however, will not be included in this limit.

(f) A student may be denied registration in a course due to reasons of paucity of staff or space or other facilities, especially in case the student is registering a course for improving the grade in a passed course.

(g) If a student fails to register in two consecutive semesters without specific permission from the Dean, his/her name may be removed from the rolls of the faculty. Such a student may apply to the Dean for re-admission stating the reasons for not being
able to register for two consecutive semesters and the Dean will take suitable decision on the merit of the case.

7.2 Graduating Course

A student may be allowed to register for one course of not more than 5 credits if he/she is able to graduate by passing such a course, irrespective of whether the course is being offered in the current semester to regular students or not, provided that the student has fulfilled the attendance requirement earlier and has been awarded E or I grade in that course. Such a course shall be known as a graduating course.

8. Attendance (In lieu of Chapter XVII of the Academic Ordinances)

Attendance in each course separately is compulsory at least once. Students who have put in 75% or more attendance in a course in a semester will be eligible to appear in the End-Semester Examination of that course. Students who have put in 65% or more but less than 75% attendance in a course may be considered for condonation of shortage of attendance in that course by the condonation committee. Students whose attendance in a course is less than 65% or whose shortage in attendance has not been condoned will not be eligible to appear in the End-Semester Examination of that course and will be awarded grade ‘F’ in that course and all marks obtained in any component of the course-evaluation will stand cancelled. However, in case a student is repeating a course and the student has already fulfilled the attendance requirement in that course, he/she will not be detained due to shortage of attendance in that course during the repeating semester.

9. Examination and Evaluation (In lieu of Clause (9) of Chapter XV of the existing Academic Ordinances)

9.1 Components of Evaluation

Each course will be evaluated out of 100 marks. The courses will normally have the following components of evaluation:

a. Theory courses:
   - Course work: 15 marks
   - Mid-Semester Examination: 25 marks
   - End-Semester Examination: 60 marks

b. Laboratory courses including Seminar, Colloquium, Project, etc.
   - Course work: 60 marks
   - End-Semester Examination: 40 marks

However, for special academic reasons, some courses may have different weight for different components of evaluation from that given above. Such special reasons will be spelt out clearly in the curriculum.

9.2 Grading System
The combined marks obtained by a student in various components of evaluation of a course shall be converted into regular letter grades with their equivalent grade points as specified below:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>Outstanding</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>Very good</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>Good</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>Satisfactory (Minimum Pass Grade)</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>Unsatisfactory (Fail)</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>Detained due to shortage of attendance</td>
</tr>
<tr>
<td>I</td>
<td>0</td>
<td>Incomplete/Absent in the End-Semester Examination</td>
</tr>
<tr>
<td>Z</td>
<td>0</td>
<td>Cancelled due to other reasons</td>
</tr>
</tbody>
</table>

The following marks ranges may ordinarily be used for the award of grades to the students in a course.

<table>
<thead>
<tr>
<th>Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 and above</td>
<td>A</td>
</tr>
<tr>
<td>60 and above but less than 75</td>
<td>B</td>
</tr>
<tr>
<td>45 and above but less than 60</td>
<td>C</td>
</tr>
<tr>
<td>35 and above but less than 45</td>
<td>D</td>
</tr>
<tr>
<td>Less than 35</td>
<td>E</td>
</tr>
</tbody>
</table>

Two grace marks may be awarded by the examiner for passing a course and one grace mark may be awarded by the examiner to elevate the grade. Any fraction in any component of evaluation should be rounded off to the next whole number.

The examiner(s) may propose higher or lower grade ranges depending upon the nature of the course and general performance of the students in the course, but the final decision rests with the Result Moderation Committee. However, the minimum passing grade `D` should never be awarded if a student secures below 35 marks (including 2 grace marks) in a course.

**9.3 Evaluation of a Graduating Course**

A graduating course shall be evaluated on the basis of the End-Semester Examination component of the course alone. The student shall appear only in the End-Semester Examination of the graduating course. Grade D shall be awarded if the student concerned obtains 35 or more of the marks allotted to End-Semester Examination alone. In case the marks obtained are less than 35, grade E will be awarded. Two grace marks, however, will be awarded for passing the course.

**9.4 Earned Credits (EC)**

If a student passes a course by obtaining grade D or above he/she earns the credits assigned to that course.

**9.5 Performance Indices**
At the end of every semester a student’s performance will be indicated by Earned Credits (EC), a Semester Performance Index (SPI), and a Cumulative Performance Index (CPI). The SPI is the credit-weighted average of grade points of all courses registered during a semester and is computed as follows:

\[ SPI = \frac{(C1G1 + C2G2 + \ldots)}{(C1 + C2 + \ldots)} \]

Where \( C1, C2, \ldots \) are the credits assigned to courses and \( G1, G2, \ldots \) are the grade points earned in those courses.

The CPI is the credit-weighted average of grade points of all courses passed in all the semesters since admission.

9.6 Repetition of a Failed Course

If a student fails in a course his/her marks of all components of evaluation in that course will be cancelled. The student will have to register the course again or its alternative and will be required to appear in all components of evaluation afresh. No previous marks shall be used in any case.

9.7 Repetition of a Passed Course

A student may repeat a course to try to improve his/her grade in that course only once, provided that the/she has passed that course in a single attempt. In such case the student will have to register the course again and will be required to appear in all components of evaluation afresh. No previous marks shall be used in any case. For the purpose of Calculating the SPI the recently obtained grade will be considered while for CPI the better of the two grades will be counted.

9.8 Conduct of Examinations

a. The examiners for the End-Semester Examination of all theory courses will normally be the teacher(s) associated with the course. The Seminar, Colloquium courses will be examined by the teacher(s) associated with the course and one or more examiners from among the teachers of the department to be recommended by the BOS of the department concerned. The laboratory and project courses will be examined by the teacher(s) associated with the course and an external examiner not in the service of the university at the time of examination. In case the external examiner does not turn up for the examination, the Chairman of the department concerned, in consultation with the course in-charge, shall call another person to act as the external examiner, even from within the University, if necessary.

b. The End-Semester Examination of all graduating courses shall be conducted simultaneously along with the End-Semester Examination of regular courses of the current semester examination.

9.9 Moderation Committees

a) Question Paper Moderation Committee: There shall be a Moderation Committee of the concerned Department consisting of the following members to moderate the Question Papers of the End-Semester Examination.

i. Chairman of the Department concerned – (Convener)
ii. One senior teacher of the Department in each broad area of specialization (to be appointed by the BOS).

Note: The Paper Setter(s) may be invited, if necessary, to clarify the necessary details of the question paper.

b) Result Moderation Committee: There shall be a Result Moderation Committee of the concerned Department consisting of the following members to moderate course-wise results of the End-Semester Examinations.
   i. Chairman of the Department concerned - (Convener)
   ii. One senior teacher of the Department in each broad area of specialization (to be appointed by the BOS).
   iii. Examiner(s) concerned.

The Result Moderation Committee will examine the result of each theory course and in case of an abnormal situation; it may take suitable corrective measures in consultation with the examiner(s). The examiner(s) will place the evaluated answer scripts along with the brief solution and marking scheme before the Committee. In case of difference of opinion among the members of the Committee, the majority decision will prevail, in which the examiner(s) will not participate.

10. Degree Requirement

a. A student who earns 200 credits subject to the break up in various course categories and fulfils such other conditions as may be mentioned in the curriculum will be awarded the degree of Bachelor of Technology. He/she must also pay all University dues as per rules. Moreover, there should be no case of indiscipline pending against him/her.

b. If a student earns more credits than the minimum required for the award of degree, his/her CPI will be calculated by considering the best grades subject to fulfilling the criteria of required credits as specified in the curriculum.

11. Name Removal from the Rolls of the University and Mercy Appeal

11.1 Name Removal

The earned credits (EC) of every student will be checked at the end of even number of semesters and if the total credits earned by the student are less than the minimum required as given below his/her admission to the B. Tech. program will be cancelled and his/her name will be removed from the rolls of the University.

Check Point (No. of semesters after admission)  Minimum EC requirement
2 semesters 0
4 semesters 25
6 semesters 50
8 semesters 80
10 semesters 110
12 semesters 140
14 semesters 200

11.2 Mercy Appeal

If the name of a student is removed from the rolls of the University as per provisions of clause 11.1 of these ordinances, he/she may appeal to the Vice-Chancellor stating the reasons for not being able to earn the required credits and the Vice-Chancellor, if he is satisfied with the reasons, may allow the continuation of admission of the student only once during the tenure of the program, extending the total duration of the program by two semesters, at the maximum, beyond 14 semesters, if required. Under no circumstances a student will be allowed to complete the program after the lapse of 16 semesters after admission.

12. Result

a) If a student passes all the examinations and fulfils all the requirements for the award of degree his/her result will be shown as “Graduated”.

b) The Division awarded to “Graduated” students will be based on CPI as given below:

First Division (Honours) CPI ≥ 8.5
First Division 6.5 ≤ CPI < 8.5
Second Division CPI < 6.5

There shall be no formula for conversion of CPI or SPI into equivalent percentage of marks during the program. However, once the program is completed by a student and he/she is graduated, his/her final CPI will be converted into equivalent percentage of marks by the following formula:

\[ y = \frac{20x^3 - 380x^2 + 2725x - 1690}{84} \]

Where y is the percentage of marks and x is the CPI.

c) If a student earns more credits than the minimum required as given in the table in clause 11.1 before fulfilling the degree requirements, his/her result will be shown as “Continued”.

d) If the name of a student is removed from the rolls of the University as per provisions of clause 11.1 of these ordinances his/her result will be shown as “Name Removed”.

e) Ranks/Positions will be determined at the end of even semesters. Only those students who fulfil the following conditions will be eligible for ranks/positions:

i. They do not have any break in their studies.
ii. They have passed every scheduled course in first attempt.
iii. They have passed every course on time as per the curriculum.
iv. They have earned credits as per the schedule given in the curriculum.
v. They have not improved grade in any course after passing the course.

The students who violate any of the above conditions will not be awarded any rank/position. The ranks/positions will be determined on the basis of CPI.
13. Transitory Ordinance

Candidates admitted prior to the implementation of these Ordinances shall be governed by the Ordinances (Academic) under which they were admitted. Students who fail in the courses that are no more offered in these new ordinances and new curriculum will be allowed to pass the alternative courses, and in case there are no alternative courses, the old courses may be offered. For such candidates, any marks obtained earlier shall not be taken into account for passing the course(s) and they will have to obtain marks in all components of evaluation afresh. A student admitted previously may apply to the Dean through the Chairman concerned, to be governed by these ordinances. Such cases may be allowed on a case by case basis.
1. Explanations

1.1 Course Number

Every course has a course number consisting of 5 characters (minimum) and 6 characters (maximum). The first two characters are alphabets indicating the department that offers or coordinates the course; the third character is a numerical digit indicating the year of offering the course in the program; the fourth character is a numerical digit indicating the type of course; the fifth character is a numerical digit that does not indicate any particular thing; and the sixth character is optional.

(a) The first two alpha characters will mean the following:

AC = Department of Applied Chemistry
AM = Department of Applied Mathematics
AP = Department of Applied Physics
AR = Department of Architecture
CE = Department of Civil Engineering
CH = Department of Chemical Engineering
CO = Department of Computer Engineering
EE = Department of Electrical Engineering
EL = Department of Electronics Engineering
ME = Department of Mechanical Engineering
PK = Department of Petroleum Studies
EZ = Departments external to Z.H. College of Engineering & Technology

(b) The third character will be 1, 2, 3, or 4 indicating First Year, Second Year, Third Year or Fourth Year of the B. Tech. program.

(c) The fourth character will be interpreted as follows:

1-7 = Theory courses
8 = Courses such as Seminar, Colloquium, Field work, etc.
9 = Laboratory/Practical courses and Projects.

1.2 Faculty Number

Every student has a Faculty number consisting of 8 characters. The first two characters are numerical digits indicating the year of admission; the third and fourth characters are alphabets indicating the branch of the B. Tech. program; the fifth character is always “B” indicating B. Tech. program; the sixth, seventh and eighth characters are numerical digits that are for identifying a student of a particular batch.

(a) The first two characters will be the right most two digits of the year of admission. Thus students admitted in 2011 will have the first two characters as 11.

(b) The third and fourth characters will be interpreted as follows:
1.3 Marks
   a) The combined total marks obtained by a student in the course work and the mid-
      semester examination will be called Sessional Marks.
   b) The marks obtained by a student in the end-semester examination will be called
      Examination Marks.

2. Conduct of Teaching

2.1 Course In-charge

Every course will be taught by one or more teachers. The BOS of the concerned
department will allocate the teaching load to the teacher(s) and will also designate a course
in-charge for each course. If more than one department is involved in the teaching of the
course, the course in-charge will be from the coordinating department. The course in-
charge will coordinate all the work related to attendance, coursework, examination and
evaluation. It is necessary that the students are informed about the course in-charge so that
they may contact him/her about any problems regarding the course.

2.2 Display of Attendance, Marks etc.

It is essential that the attendance should be displayed to the students twice in a semester,
once in the middle and then at the end of a semester by the teachers concerned. The mid-
semester marks should be displayed to students normally within 15 days of the
examination. The total Sessional marks should be displayed to the students before the
beginning of the end-semester examinations. The course in-charge will ensure that the
teachers associated with the course make such displays and, in case of complaints from
the students in this regard, shall inform the Chairman of the concerned department about
the problem.

2.3 Offering Courses

   a) Courses will be offered by the department concerned as per the schedule given in
      the relevant Curriculum. Departments may also offer a course in both the semesters
      even though it may be shown in a particular semester.
   b) Department Elective (DE) courses will be offered depending on the availability of the
      staff and other facilities and therefore any particular elective course may not be
      offered even though it may exist in the list of possible elective courses.
c) The advisement for Open Elective (OE) courses in various departments will be based on the guidelines approved by the respective Board of Studies.

2.4 Syllabus

Each course will have a syllabus which will be distributed to the students. The teacher(s) concerned should ensure that some portion, beyond the syllabus, should also be covered in the class.

3. Correction of Errors

In case any error is detected in the marks recorded on the award list, the examiner(s) concerned shall make a request to correct the mistake to the Dean, Faculty of Engg. & Tech. through the Chairman of the concerned department, and shall attach relevant documentary evidence. A committee consisting of the following members shall take suitable remedial measures depending upon the merit of the case.

1. Dean, Faculty of Engg. & Tech. (Chairman)
2. Principal, ZH College of Engg. & Tech.
3. Chairman of the concerned department.
4. One senior member of the Faculty, not belonging to the concerned department, to be nominated by the Dean.

4. Examinations

4.1 Mid-Semester Examination

Mid-semester examination(s) of each course will be of one hour duration and will be conducted as per norms and schedule notified by the office of the Dean in each semester.

4.2 End-Semester Examination

End-semeser examination(s) of each theory course shall be of three hours duration and will be conducted as per norms and schedule notified by the Controller of Examination of the University on the advice of the Dean. The end-semeser examinations of laboratory/practical courses, and other courses such as seminar, colloquium, field work and project etc. shall be conducted as notified by the Dean/Chairman concerned.

4.3 Make-up Test

Students who miss the Mid-Semester Examination in a course due to illness or some other extra-ordinary compelling situation may contact the teacher(s) concerned of the course with the request to conduct a make-up test. The teacher(s) shall follow the guidelines in this regard approved by the Faculty from time to time. There shall be no make-up test/examination for end-semester examinations.