B. Tech 1st Year (All branches except Bio Technology and Agriculture Engg.) Structure in accordance with AICTE Model Curriculum Effective w.e.f. Academic Session 2018-19

SEMESTER - I

Sl. No.	Code	SUBJECT	PERIODS			EVALUATION SCHEME				END SEMESTER		TOTAL	CREDIT
			L	T	P	CT	TA	Total	PS	TE	PE		
3 WEEKS COMPULSORY INDUCTION PROGRAM													
1	**KAS101/ KAS102**	Physics/Chemistry	3	1	3	30	20	50	25	100	25	200	5.5
2	**KAS103**	Mathematics-I	3	1	0	30	20	50	-	100	-	150	4
3	**KEE 101/ KCS101**	Basic Electrical Engineering/Programming for Problem Solving	3	1	2	30	20	50	25	100	25	200	5
4	**KCE101/ KWS101**	Engineering Graphics & Design/Workshop Practices	1	0	4	-	-	-	25	-	25	50	3
	MOOCs (For B.Tech. Hons. Degree**)***												0
		TOTAL										600	17.5

SEMESTER II

Sl. No.	Code	SUBJECT	PERIODS			EVALUATION SCHEME				END SEMESTER		TOTAL	CREDIT
			L	T	P	CT	TA	Total	PS	TE	PE		
1	**KAS201/ KAS202**	Physics/Chemistry	3	1	3	30	20	50	25	100	25	200	5.5
2	**KAS203**	Mathematics II	3	1	0	30	20	50	-	100	-	150	4
3	**KEE201/ KCS201**	Basic Electrical Engineering/Programming for Problem Solving	3	1	2	30	20	50	25	100	25	200	5
4	**KCE201/ KWS201**	Engineering Graphics & Design/Workshop Practices	1	0	4	-	-	-	25	-	25	50	3
5	**KAS204**	Professional English	2	0	2	30	20	50	-	100	-	150	3
	MOOCs (For B.Tech. Hons. Degree**)***												0
		TOTAL										750	20.5
Mini Project or Internship (3-4 weeks) shall be conducted during summer break after II semester and will be assessed during III semester													

*** List of MOOCs (NPTL) Based Recommended Courses for first year B. Tech Students**

1. Developing Soft Skills and personality-Odd Semester-8 Weeks-3 Credits
2. Enhancing Soft Skills and personality-Even Semester-8 Weeks-3 Credits

*** AICTE Guidelines in Model Curriculum:**

After successful completion of 160 credits, a student shall be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours only, if he/she completes additional university recommended courses only (Equivalent to 20 credits; NPTEL Courses of 4 Weeks, 8 Weeks and 12 Weeks shall be of 2, 3 and 4 Credits respectively) through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MooCs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only. The student shall be awarded Hons. Degree (on successful completion of MOOCS based 20 credit) only if he/she secures 7.50 or above CGPA and passed each subject of that Degree Programme in single attempt without any grace marks.

SEMESTER – I

A Guide to Induction Program

1 Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.1 This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.)

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students. The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them

A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31

March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs, work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

2. Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

[2]Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gandhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

1. IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

2. IIIT Hyderabad was the first one to implement a compulsory course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the

course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

3. Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member.

Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of

relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.[3]

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have,
for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

3 Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

3.1 Initial Phase

Time	Activity
Day 0	
Whole day	Students arrive - Hostel allotment. (Preferably do pre allotment)
Day 1	
09:00 am - 03:00 pm	Academic registration
04:30 pm - 06:00 pm	Orientation
Day 2	
09:00 am - 10:00 am	Diagnostic test (for English etc.)
10:15 am - 12:25 pm	Visit to respective depts.
12:30 pm - 01:55 pm	Lunch
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group. (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods
within the Induction Program. We first show a typical daily timetable.

Session.	Time	Activity	Remarks
Day 3 onwards			
	06:00 am	Wake up call	
I	06:30 am - 07:10 am	Physical activity (mild exercise/ yoga)	
	07:15 am - 08:55 am	Bath, Breakfast, etc.	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values/ Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	Lunch	
IV	02:30 pm - 03:55 pm	Afternoon Session See below.	
V	04:00 pm - 05:00 pm	Afternoon Session See below.	
	05:00 pm - 05:25 pm	Break / light tea	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	Rest and Dinner	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	Session	Remarks
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book	IV	For 3-5 days

Reading / Lecture)		
Proficiency Modules	V	Daily, but only for those who need it

3.3 Closing Phase

Time	Activity
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline. Here we list some important suggestions which have come up and which have been experimented with.

3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters.
It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

4 Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The Induction Programis designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The Universal Human Valuescomponent, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and we are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept. nature, and character to follow through. It also makes them reflect on their relationshipwith their families and extended family in the college (with hostel staff and others). It alsoconnects students with each other and with teachers so that they can share any difficultythey might be facing and seek help.

References:

Motivating UG Students Towards Studies, Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors), 31 March 2016, IIT Directors' Secretariat, IIT Delhi.

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18 June 2017

PHYSICS

Module - 1 Relativistic Mechanics: [8]

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein's mass energy relation, Relativistic relation between energy and momentum, Massless particle.

Module- 2 Electromagnetic Field Theory: [8]

Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell's equations in vacuum and in non conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

Module- 3 Quantum Mechanics: [8]

Black body radiation, Stefan's law, Wien's law, Rayleigh-Jeans law and Planck's law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

Module- 4 Wave Optics: [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton's Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh's criterion of resolution, Resolving power of grating.

Module- 5Fibre Optics & Laser: [10]

Fibre Optics**:** Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres.
Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Course Outcomes:

1. To solve the classical and wave mechanics problems
2. To develop the understanding of laws of thermodynamics and their application in various processes
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic Field Theory
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams

Reference Books:

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)

2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics - Brijlal& Subramanian (S. Chand)
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

Physics Lab

List of Experiments

Any ten experiments (at least four from each group).

Group A

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the specific rotation of cane sugar solution using polarimeter.
4. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
5. To measure attenuation in an optical fiber.
6. To determine the wavelength of He-Ne laser light using single slit diffraction.
7. To study the polarization of light using He-Ne laser light.
8. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
9. To determine the coefficient of viscosity of a given liquid.
10. To determine the value of acceleration due to gravity (g) using compound pendulum.

Group B

1. To determine the energy band gap of a given semiconductor material.
2. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To verify Stefan's law by electric method.
5. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
6. To study the resonance condition of a series LCR circuit.
7. To determine the electrochemical equivalent (ECE) of copper.
8. To calibrate the given ammeter and voltmeter by potentiometer.
9. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
10. To measure high resistance by leakage method.

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (KrishnaPrakashan Meerut)

Course Outcomes:

1. To determine the wavelength of sodium light by Newton's ring experiment
2. To determine the wavelength of sodium light with the help of Fresnel's bi-prism
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

CHEMISTRY

Module-1 **[08]**

Atomic and Molecular Structure:

Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nanomaterials and its application.

Module-2 **[08]**

Spectroscopic techniques and Applications:

Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy.

Module-3 **[08]**

Electrochemistry

Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH, ΔF and ΔS). Lead storage battery.

Corrosion; causes, effects and its prevention.

Phase Rule and its application to water system.

Module-4 **[08]**

Water Analysis; Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method).

Fuels: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeterand Dulong'smethos).

Module-5 **[08]**

Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene). General methods of synthesis of organometallic compounds (Grignard reagent) and their applications.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

Reference Books:

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry ByFre W., Billmeyer
7. Engineering ChemistryBy Satya Prakash

CHEMISTRY- PRACTICAL

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA.
3. Determination of iron content in the given solution by Mohr's method.
4. Determination of viscosity of given liquid.
5. Determination of surface tension of given liquid.
6. Determination of chloride content in water sample.
7. Determination of available chlorine in bleaching powder.
8. Determination of pH by pH-metric titration.
9. Preparation of Phenol-formaldehyde and Urea-formaldehyde resin.
10. Determination of Cell constant and conductance of a solution.
11. Determination of rate constant of hydrolysis of esters.
12. Verification of Beer's law.

NOTE: Choice of any 10 experiments from the above. Institute can change any 02 experiments from the aforesaid experiments.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

MATHEMATICS-I

(Common to all B. Tech. Courses except B. Tech. (Biotechnology)&B. Tech. (Agricultural Engineering)

Module 1: Matrices [08]

Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix,

Module 2: Differential Calculus- I [08]

Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (n^{th} order derivatives), Leibnitz theorem and its application, Envelope, Involutes and Evolutes, Curve tracing: Cartesian and Polar co-ordinates

Module 3: Differential Calculus-II [08]

Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of one and two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors.

Module 4: Multivariable Calculus-I [08]

Multiple integration: Double integral, Triple integral, Change of order of integration, Change of variables, **Application:** Areas and volumes, Center of mass and center of gravity (Constant and variable densities),

Module 5: Vector Calculus [08]

Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem (without proof) and their applications.

COURSE OUTCOMES

1. Remember the concept of matrices and apply for solving linear simultaneous equations.
2. Understand the concept of limit, continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitz theorems .
3. Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.
4. Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.
5. Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.

Reference Books-

1.E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.

2.Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.

3.Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.

4.D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

5.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

6.Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.

7.P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd

8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.

9. Engineering Mathemathics – I. Reena Garg, 2018.

BASIC ELECTRICAL ENGINEERING

Module - 1: DC Circuits **[08]**

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem.

Module - 2: Steady- State Analysis of Single Phase AC Circuits **[10]**

Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor.

Three phase balanced circuits, voltage and current relations in star and delta connections.

Module - 3 : Transformers **[08]**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module –4 : Electrical machines **[08]**

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Module –5 : Electrical Installations **[06]**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries.Elementary calculations for energy consumption and savings, battery backup.

COURSE OUTCOMES

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behavior of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Spoken Tutorial (MOOCs):

1. AC DC Circuit Analysis using NgSpice, Open Source Software (http://spoken-tutorial.org)

Text Books:

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.

2. S. Singh, P.V. Prasad, "Electrical Engineering: Concepts and Applications" Cengage.

3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.

4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.

3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

ELECTRICAL ENGINEERING LABORATORY

LIST OF EXPERIMENTS

Note: A minimum of ten experiments from the following should be performed.

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
10. Determination of efficiency of a dc shunt motor by load test
11. To study running and speed reversal of a three phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

COURSE OUTCOMES

1. Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
2. Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
3. Perform experiment illustrating BH curve of magnetic materials.
4. Calculate efficiency of a single phase transformer and DC machine.
5. Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.

Programming for Problem Solving

Module – 1 : **(Introduction to Programming)** **[08]**

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.

Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.

Module – 2 : **(Arithmetic expressions & Conditional Branching)** **[08]**

Arithmetic expressions and precedence: Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity.

Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.

Module – 3 : **(Loops & Functions)** **[08]**

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

Module – 4 : **(Arrays & Basic Algorithms)** **[08]**

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, Passing arrays to functions.

Basic Algorithms: Searching &Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

Module – 5 :**(Pointer& File Handling)** **[08]**

Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation)

File handling: File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

COURSE OUTCOMES

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Text books:

1. Schum's Outline of Programming with C by Byron Gottfried, McGraw-Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
7. Let Us C By Yashwant P. Kanetkar.
8. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson
   Addison-Wesley, 2006.
9. Programming in C by Kochan Stephen G. Pearson Education – 2015.
10. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New AgeInternational Publication.
11. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication.
12. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
13. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
14. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House

Programming for Problem Solving Lab

Other Reference: -

1. Use C Open Source Software referring Spoken Tutorial MOOC

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

Between 90-100%----------Print 'A'

80-90%----------Print 'B'

60-80%----------Print 'C'

Below 60%----------Print 'D'

11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.

21. WAP that simply takes elements of the array from the user and finds the sum of these elements.

22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.

23. WAP to find the minimum and maximum element of the array.

24. WAP to search an element in a array using Linear Search.

25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

26. WAP to add and multiply two matrices of order nxn.

27. WAP that finds the sum of diagonal elements of a mxn matrix.

28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:

(i) List all the trains (sorted according to train number) that depart from a particular section.

(ii) List all the trains that depart from a particular station at a particular time.

(iii) List all he trains that depart from a particular station within the next one hour of a given time.

(iv) List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.

31. WAP to compare the contents of two files and determine whether they are same or not.

32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

COURSE OUTCOMES

1. To write programs for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To write programs for conditional branching, iteration and recursion.
4. To write programs using functions and synthesize a complete program using divide and conquer approach.
5. write programs using arrays, pointers and structures.

Engineering Graphics and Design

Module 1: Introduction to Engineering Drawing, Orthographic Projections [08]

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales
Principles of Orthographic Projections – Conventions – Projections of Points and Lines inclined to both planes; Projections of planes inclined Planes – Auxiliary Planes.

Module 2: Projections and Sections of Regular Solids [08]

Sections in lined to both the Planes – Auxiliary Views; Simple annotation, dimensioning and scale. Floor plans the include: windows, doors and fixtures such as WC, Both, sink, shower, etc.
Prism, Cylinder, Pyramid, Cone – Auxiliary Vies: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and Cone.

Module 3: Isometric Projections [08]

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conversions.

Module 4: Computer Graphics [08]

Listing the computer technologies the impact on graphical communication, Demonstration knowledge of the theory of CAD software [such as: The Menu System, Tollbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects: Isometric Views of lines, Planes, Simple and compound Solids];

Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles:

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to pater using the print command: orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, Multiview, auxiliary, and section views. Spatial visualization exercises Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling:

Module 5: Demonstration of a simple team design project [08]

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Course Outcomes

1: Understanding of the visual aspects of engineering design
2: Understanding of engineering graphics standards and solid modelling
3: Effective communication through graphics
4: Applying modern engineering tools necessary for engineering practice
5: Appling computer-aided geometric design
6: Analysis of Isometric views
7: Creating working drawings

Suggested Text/ Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
(iv) Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House
(v) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
(vi) (Corresponding set of) CAD Software Theory and User Manuals.

WORKSHOP PRACTICE

LIST OF EXPERIMENTS

Machine shop:

- Study of machine tools in particular Lathe machine
- Demonstration of different operations on Lathe machine
- Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting.
- Study of Quick return mechanism of Shaper.

Fitting shop:

- Preparation of T-Shape Work piece as per the given specifications.
- Preparation of U-Shape Work piece which contains: Filing, Sawing, Drilling, Grinding.
- Practice marking operations.

Carpentry:

- Study of Carpentry Tools, Equipment and different joints.
- Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

Electrical & Electronics

- Introduction to House wiring, different types of cables. Types of power supply, types of motors, Starters, distribution of power supply, types of bulbs, parts of tube light, Electrical wiring symbols.
- Soldering and desoldering of Resistor in PCB.
- Soldering and desoldering of IC in PCB.
- Soldering and desoldering of Capacitor in PCB

Welding:

- Instruction of BI standards and reading of welding drawings.
- Butt Joint
- Lap Joint
- TIG Welding
- MIG Welding

Casting:

- introduction to casting processes

Smithy

- Sharpening any arc and edge.
- Preparing small arc and edge,
- Repair of agricultural implements and power plough, use of power hammer etc.

Plastic Moulding& Glass Cutting

- Introduction to Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes
- Demo of mould preparation
- Practice – Preparation of mould
- Glass cutting

COURSE OUTCOMES

1. Study and practice on machine tools and their operations
2. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding
3. Identify and apply suitable tools for machining processes including turning, facing, thread cutting and tapping
4. Welding and soldering operations
5. Apply basic electrical engineering knowledge for house wiring practice

Text Books:

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
4. JeyapoovanT.and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

SEMESTER - II

PHYSICS

Module - 1 Relativistic Mechanics: [8]

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein's mass energy relation, Relativistic relation between energy and momentum, Massless particle.

Module- 2 Electromagnetic Field Theory: [8]

Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell's equations in vacuum and in non-conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

Module- 3 Quantum Mechanics: [8]

Black body radiation, Stefan's law, Wien's law, Rayleigh-Jeans law and Planck's law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

Module- 4 Wave Optics: [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton's Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, Absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh's criterion of resolution, Resolving power of grating.

Module- 5Fibre Optics & Laser: [10]

Fibre Optics**:** Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres.

Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Course Outcomes:

1. To solve the classical and wave mechanics problems
2. To develop the understanding of laws of thermodynamics and their application in various processes
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic Field Theory
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams

Reference Books:

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics - Brijlal& Subramanian (S. Chand)
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

PHYSICS LAB

List of Experiments (Any ten experiments (at least four from each group).

Group A

11. To determine the wavelength of sodium light by Newton's ring experiment.
12. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
13. To determine the specific rotation of cane sugar solution using polarimeter.
14. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
15. To measure attenuation in an optical fiber.
16. To determine the wavelength of He-Ne laser light using single slit diffraction.
17. To study the polarization of light using He-Ne laser light.
18. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
19. To determine the coefficient of viscosity of a given liquid.
20. To determine the value of acceleration due to gravity (g) using compound pendulum.

Group B

11. To determine the energy band gap of a given semiconductor material.
12. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
13. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
14. To verify Stefan's law by electric method.
15. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
16. To study the resonance condition of a series LCR circuit.
17. To determine the electrochemical equivalent (ECE) of copper.
18. To calibrate the given ammeter and voltmeter by potentiometer.
19. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
20. To measure high resistance by leakage method.

Course Outcomes:

1. To determine the wavelength of sodium light by Newton's ring experiment
2. To determine the wavelength of sodium light with the help of Fresnel's bi-prism
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (KrishnaPrakashan Meerut)

CHEMISTRY

Module-1 **[08]**

Atomic and Molecular Structure:

Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nanomaterials and its application.

Module-2 **[08]**

Spectroscopic techniques and Applications:

Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy.

Module-3 **[08]**

Electrochemistry

Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH, ΔF and ΔS). Lead storage battery.

Corrosion; causes, effects and its prevention.

Phase Rule and its application to water system.

Module-4 **[08]**

Water Analysis; Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method).

Fuels: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeterand Dulong'smethos).

Module-5 **[08]**

Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene). General methods of synthesis of organometallic compounds (Grignard reagent) and their applications.

Course Outcomes:

1. Get an understanding of the theoretical principles understanding molecular structure, bonding and properties.
2. Know the fundamental concepts of determination of structure with various techniques.
3. Know the fundamental concepts of chemistry applicable in industrial processes.

Reference Books:

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
7. Polymer Chemistry ByFre W., Billmeyer
8. Engineering Chemistry By Satya Prakash

CHEMISTRY- PRACTICAL

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA.
3. Determination of iron content in the given solution by Mohr's method.
4. Determination of viscosity of given liquid.
5. Determination of surface tension of given liquid.
6. Determination of chloride content in water sample.
7. Determination of available chlorine in bleaching powder.
8. Determination of pH by pH-metric titration.
9. Preparation of Phenol-formaldehyde and Urea-formaldehyde resin.
10. Determination of Cell constant and conductance of a solution.
11. Determination of rate constant of hydrolysis of esters.
12. Verification of Beer's law.

NOTE: Choice of any 10 experiments from the above. Institute can change any 02 experiments from the aforesaid experiments.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

MATHEMATICS-II

(Common to all B. Tech. Courses except B. Tech., Biotechnology and Agricultural Engineering)

Module 1: Ordinary Differential Equation of Higher Order [10]

Linear differential equation of n^{th} order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation, Series solutions (Frobenius Method).

Module 2: Multivariable Calculus-II [08]

Improper integrals, Beta & Gama function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

Module 3: Sequences and Series [08]

Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

Module 4: Complex Variable – Differentiation [08]

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties

Module 5: Complex Variable –Integration [08]

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouvilles's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{\infty} f(x)\, dx$.

COURSE OUTCOMES

1. Understand the concept of differentiation and apply for solving differential equations.
2. Remember the concept of definite integral and apply for evaluating surface areas and volumes.
3. Understand the concept of convergence of sequence and series. Also evaluate Fourier series
4. Illustrate the working methods of complex functions and apply for finding analytic functions.
5. Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger , Advance Engineering Mathematics , Narosa Publishing -House, 2002.

Reference Books:-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-Tata McGraw-Hill
6. D. Poole , Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, Tata McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, Tata McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi

BASIC ELECTRICAL ENGINEERING

Module - 1: DC Circuits **[08]**

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem.

Module - 2: Steady- State Analysis of Single Phase AC Circuits **[10]**

Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor.

Three phase balanced circuits, voltage and current relations in star and delta connections.

Module - 3 : Transformers **[08]**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module –4 : Electrical machines **[08]**

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Module –5 : Electrical Installations **[06]**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries.Elementary calculations for energy consumption and savings, battery backup.

COURSE OUTCOMES

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behavior of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Spoken Tutorial (MOOCs):

1. AC DC Circuit Analysis using NgSpice, Open Source Software (http://spoken-tutorial.org)

Text Books:

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.

2. S. Singh, P.V. Prasad, "Electrical Engineering: Concepts and Applications" Cengage.

3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.

4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.

3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

ELECTRICAL ENGINEERING LABORATORY

LIST OF EXPERIMENTS

Note: A minimum of ten experiments from the following should be performed.

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
10. Determination of efficiency of a dc shunt motor by load test
11. To study running and speed reversal of a three phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

COURSE OUTCOMES

1. Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
2. Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
3. Perform experiment illustrating BH curve of magnetic materials.
4. Calculate efficiency of a single phase transformer and DC machine.
5. Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.

Programming for Problem Solving

Module – 1 : **(Introduction to Programming)** **[08]**

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.

Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.

Module – 2 : **(Arithmetic expressions & Conditional Branching)** **[08]**

Arithmetic expressions and precedence: Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity.

Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.

Module – 3 : **(Loops & Functions)** **[08]**

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

Module – 4 : **(Arrays & Basic Algorithms)** **[08]**

Arrays: Array notation and representation, manipulating array elements, using multi-dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, passing arrays to functions.

Basic Algorithms: Searching &Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

Module – 5 :**(Pointer& File Handling)** **[08]**

Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation)

File handling: File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

COURSE OUTCOMES

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Text books:

1. Schum's Outline of Programming with C by Byron Gottfried, McGraw-Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
7. Let Us C By Yashwant P. Kanetkar.
8. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
9. Programming in C by Kochan Stephen G. Pearson Education – 2015.
10. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New AgeInternational Publication.
11. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication.
12. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
13. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
14. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House

Programming for Problem Solving Lab

Other Reference: -

1. Use C Open Source Software referring Spoken Tutorial MOOC

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

Between 90-100%----------Print 'A'

80-90%----------Print 'B'

60-80%----------Print 'C'

Below 60%----------Print 'D'

11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.

23. WAP to find the minimum and maximum element of the array.

24. WAP to search an element in a array using Linear Search.

25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

26. WAP to add and multiply two matrices of order nxn.

27. WAP that finds the sum of diagonal elements of a mxn matrix.

28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:

(i) List all the trains (sorted according to train number) that depart from a particular section.

(ii) List all the trains that depart from a particular station at a particular time.

(iii) List all he trains that depart from a particular station within the next one hour of a given time.

(iv) List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.

31. WAP to compare the contents of two files and determine whether they are same or not.

32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

COURSE OUTCOMES

1. To write programs for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To write programs for conditional branching, iteration and recursion.
4. To write programs using functions and synthesize a complete program using divide and conquer approach.
5. write programs using arrays, pointers and structures.

Engineering Graphics and Design

Module 1: Introduction to Engineering Drawing, Orthographic Projections [08]

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales
Principles of Orthographic Projections – Conventions – Projections of Points and Lines inclined to both planes; Projections of planes inclined Planes – Auxiliary Planes.

Module 2: Projections and Sections of Regular Solids [08]

Sections in lined to both the Planes – Auxiliary Views; Simple annotation, dimensioning and scale. Floor plans the include: windows, doors and fixtures such as WC, Both, sink, shower, etc.
Prism, Cylinder, Pyramid, Cone – Auxiliary Vies: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and Cone.

Module 3: Isometric Projections [08]

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conversions.

Module 4: Computer Graphics [08]

Listing the computer technologies the impact on graphical communication, Demonstration knowledge of the theory of CAD software [such as: The Menu System, Tollbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects: Isometric Views of lines, Planes, Simple and compound Solids];

Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles:

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to pater using the print command: orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, Multi view, auxiliary, and section views. Spatial visualization exercises Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling:

Module 5: Demonstration of a simple team design project [08]

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Course Outcomes

1: Understanding of the visual aspects of engineering design
2: Understanding of engineering graphics standards and solid modelling
3: Effective communication through graphics
4: Applying modern engineering tools necessary for engineering practice
5: Appling computer-aided geometric design
6: Analysis of Isometric views
7: Creating working drawings

Suggested Text/ Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
(iv) Engineering Graphics & Design, A.P. Gautam & Pradeep Jain Khanna Publishing House
(v) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
(vi) (Corresponding set of) CAD Software Theory and User Manuals.

WORKSHOP PRACTICE

LIST OF EXPERIMENTS

Machine shop:

- Study of machine tools in particular Lathe machine
- Demonstration of different operations on Lathe machine
- Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting.
- Study of Quick return mechanism of Shaper.

Fitting shop:

- Preparation of T-Shape Work piece as per the given specifications.
- Preparation of U-Shape Work piece which contains: Filing, Sawing, Drilling, Grinding.
- Practice marking operations.

Carpentry:

- Study of Carpentry Tools, Equipment and different joints.
- Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

Electrical & Electronics

- Introduction to House wiring, different types of cables. Types of power supply, types of motors, Starters, distribution of power supply, types of bulbs, parts of tube light, Electrical wiring symbols.
- Soldering and desoldering of Resistor in PCB.
- Soldering and desoldering of IC in PCB.
- Soldering and desoldering of Capacitor in PCB

Welding:

- Instruction of BI standards and reading of welding drawings.
- Butt Joint
- Lap Joint
- TIG Welding
- MIG Welding

Casting:

- introduction to casting processes

Smithy

- Sharpening any arc and edge.
- Preparing small arc and edge,
- Repair of agricultural implements and power plough, use of power hammer etc.

Plastic Moulding& Glass Cutting

- Introduction to Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes
- Demo of mould preparation
- Practice – Preparation of mould
- Glass cutting

COURSE OUTCOMES

1. Study and practice on machine tools and their operations
2. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding
3. Identify and apply suitable tools for machining processes including turning, facing, thread cutting and tapping
4. Welding and soldering operations
5. Apply basic electrical engineering knowledge for house wiring practice

Text Books:

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
4. JeyapoovanT.and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

PROFESSIONAL ENGLISH

Module 1- Basics of Technical English **[08]**

Technical English: Definition; Extent& Coverage; Dimensions; Reading; Skimming; Scanning; Churning & Assimilation; Writing: Methods: Inductive; Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc; Technical Communication; Approaches: Brevity; Objectivity; Simplicity; Utility & Clarity. **Listening**: Active; Passive; Thinking strategies: Positive & Logical thinking; Speaking: Essentials Nuances & Modes of Speech Delivery.

Module 2- Components of Technical Writing **[08]**

Vocabulary Building: Select words; Concept of word formation; Word formation; Root words from foreign languages & their use in English; Prefixes & Suffixes: Derivatives; Synonyms; Antonyms; Abbreviations. Homophones. One word substitutes; Requisites of Sentences.

Module 3- Basic Technical Writing Skills **[08]**

Forms: Business writing: Principle; Purchase & Sales Letters; Drafts; Official Writing: Official Letter; D.O. Letter; Notices; Agenda; Minutes of Meeting; Sentence Structure; Phrases & Clauses in sentences; Coherence; Unity; Emphasis in Writing; Devices; Use of Writing methods in Documents; Techniques of writing.

Module 4- Common Grammatical Errors & Technical Style **[08]**

Subject-verb agreement; Correct usage: Noun; Pronoun; Agreement; Modifiers; Articles; Prepositions; Cliches; Redundancies; Technical Style: Features; Choice of words; Sentences: Descriptive; Narrative; Expository; Defining & Classifying; Length of paragraph; Writing of Introduction & Conclusion.

Module 5- Presentation Strategies & Oral Communications **[08]**Analysis of locale; Audience; Modulating Style & Content; Speaking with confidence; Kinesics; Paralinguistic features of Voice-Dynamics: Pitch; Intonation; Stress & Rhythm; Conversation & dialogues; Communication at work-place; etc.

COURSE OUTCOMES

1. Students will be enabled to **understand** the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.

2. Students would be able to **create** substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.

3. Students will **apply** it at their work place for writing purposes such as Presentation/official drafting/administrative communication and use it for document/project/report/research paper writing.

4. Students will be made to **evaluate** the correct & error-free writing by being well-versed in rules of English grammar & cultivate relevant technical style of communication & presentation at their work place & also for academic uses.

5. Students will **apply** it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing inter-personal communication skills and positive attitude leading to their professional competence.

Text Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
4. English Grammar, Composition and Usage by N.K.Agrawal&F.T.Wood, Macmillan India Ltd., New Delhi.
5. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
6. English Grammar & Composition by Wren & Martin, S.Chand& Co. Ltd., New Delhi.
7. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
8. Personality Development, Harold R. Wallace &L.Ann Masters, Cengage Learning, New Delhi
9. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012 New Delhi.
10. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
11. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
12. Spoken English- A manual of Speech and Phonetics by R.K.Bansal&J.B.Harrison, Orient Blackswan, 2013, New Delhi.
13. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi.

2nd Year III-SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	ROE030 to 039/ RAS301	Science Based Open Elective/ Mathematics-III	3-1-0	70	20	10	100	4
2.	RVE301/ RAS302	Universal Human Values & Professional Ethics/ Environment & Ecology	3-0-0	70	20	10	100	3
3.	REE305	Network Analysis and Synthesis	3-0-0	70	20	10	100	3
4.	REC301	Digital Logic Design	3-0-0	70	20	10	100	3
5.	REC302	Electronic Devices and Circuits	3-1-0	70	20	10	100	4
6.	REC303	Signals & Systems	3-0-0	70	20	10	100	3
7.	REC351	Digital Logic Design Lab	0-0-2	50	30	20	100	1
8.	REC352	Electronic Devices and Circuits Lab	0-0-2	50	30	20	100	1
9.	REC353	Signals & Systems Lab	0-0-2	50	30	20	100	1
10.	REC354	Electronics Workshop & PCB Design Lab	0-0-2	50	30	20	100	1
11.	RME101*	Elements of Mechanical Engineering*	3-1-0	70	20	10	100*	--
12.	RCE151*	Computer Aided Engineering Graphics*	0-0-3	50	30	20	100*	--
Total							1000	24

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

***B.Tech. IInd year lateral entry students belonging to B.Sc. Stream, shall clear the subjects RCE151/RCE251 and RME101/201 of the first year Engineering Programme along with the second year subjects.**

Science Based Open Electives:

a. ROE030/ROE040 Manufacturing Process
b. ROE031/ROE041 Introduction to soft computing
c. ROE032/ROE042 Nano Science
d. ROE033/ROE043 Laser System and Application
e. ROE034/ROE044 Space Science
f. ROE035/ROE045 Polymer Science & Technology
g. ROE036/ROE046 Nuclear Science
h. ROE037/ROE047 Material Science
i. ROE038/ROE048 Discrete Mathematics
j. ROE039/ROE049 Applied Linear Algebra

2nd Year IV-SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	RAS401/ ROE040 to 049	Mathematics-III/ Science Based Open Elective	3-1-0	70	20	10	100	4
2.	RAS402/ RVE401	Environment & Ecology/ Universal Human Values & Professional Ethics	3-0-0	70	20	10	100	3
3.	REC401	Microprocessors & Microcontrollers	3-0-0	70	20	10	100	3
4.	REC402	Electromagnetic Field Theory	3-1-0	70	20	10	100	4
5.	REC403	Electronic Measurement & Instrumentation	3-0-0	70	20	10	100	3
6.	RCS406	Data Structure & Algorithms	3-0-0	70	20	10	100	3
7.	REC451	Microprocessors & Microcontrollers Lab	0-0-2	50	30	20	100	1
8.	REC452	Advanced Electronics System Lab	0-0-2	50	30	20	100	1
9.	REC453	Electronic Measurement & Instrumentation Lab	0-0-2	50	30	20	100	1
10.	RCS456	Data Structure & Algorithms Lab	0-0-2	50	30	20	100	1
11.	RME201*	Elements of Mechanical Engineering*	3-1-0	70	20	10	100*	--
12.	RCE251*	Computer Aided Engineering Graphics*	0-0-3	50	30	20	100*	--
Total							1000	24

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

***B.Tech. IInd year lateral entry students belonging to B.Sc. Stream, shall clear the subjects RCE151/RCE251 and RME101/201 of the first year Engineering Programme along with the second year subjects.**

Science Based Open Electives:

a. ROE030/ROE040 Manufacturing Process
b. ROE031/ROE041 Introduction to soft computing
c. ROE032/ROE042 Nano Science
d. ROE033/ROE043 Laser System and Application
e. ROE034/ROE044 Space Science
f. ROE035/ROE045 Polymer Science & Technology
g. ROE036/ROE046 Nuclear Science
h. ROE037/ROE047 Material Science
i. ROE038/ROE048 Discrete Mathematics
j. ROE039/ROE049 Applied Linear Algebra

REE305: NETWORK ANALYSIS & SYNTHESIS

UNIT I

Signal Analysis, Complex Frequency, General Characteristics and Descriptions of Signals, Node Voltage Analysis, Mesh Current Analysis, Step Function and Associated Wave Forms, The Unit Impulse, Initial and final conditions, Step and Impulse Response, Response of Source Free Circuits, Forced Response, Phasor and Steady State Responses of Circuits to Sinusoidal Functions, Resonance in AC Circuits.

UNIT II

Review of Laplace Transforms, Poles and Zeroes, Initial and Final Value theorems, The transform circuit, Superposition Theorem, Thevenin's and Norton's theorems, Maximum Power Transfer Theorem, Convolution Integral, Amplitude and phase responses. Network functions.

UNIT III

Graph Theory fundamentals, Matrix Representation of Graphs, Formulation of Network Response Equations using Incidence Matrix, Duality in Networks. Computation of Ladder and Non-Ladder Networks, Routh-Hurwitz Stability Criterion, Bode Diagrams.

UNIT IV

Parameters of Two Port Networks, Correlation between Two Port Parameters, Two Port, Relation between Port Parameters, Transfer Functions using Two Port Parameters, Interconnection of TwoPorts , Reciprocal and Symmetric Networks, Terminated Two Port Networks, Interconnections of Two Port Networks, Image Impedance, Iterative Impedance. Harmonics and Dirichlet`s Conditions, Waveform Symmetry and Fourier Coefficients. Filter Networks.

UNIT V

Active Network Synthesis and Realizability: Elements of Relizability Theory, Hurwitz Polynomial, Positive Real Functions (PRF), Characteristics of PRF, Methodology for Simple Network Synthesis, Synthesis of Two Element Type One Port Network.

Text Book:

1. Franklin F. Kuo, "Network Analysis and synthesis", Wiley India Pvt Ltd.
2. MS Sukhija, T.K. Nagsarkar, "Circuits and Networks", Oxford University Publication.

Reference Books:

1. ME Van Valkenberg, "Network Analysis", Prentice Hall of India Ltd.
2. Ghosh, "Network Theory: Analysis and Synthesis", PHI Learning Pvt. Ltd

REC301: DIGITAL LOGIC DESIGN

UNIT I

Digital System And Binary Numbers: Number System and its arithmetic, Signed binary numbers, Binary codes, Cyclic codes, Hamming Code, the map method up to five variable, Don't care conditions, POS simplification, NAND and NOR implementation, Quine Mc-Clusky method (Tabular method).

UNIT II

Combinational Logic: Combinational Circuits: Analysis Procedure, Design procedure, Binary adder-subtractor, Decimal adder, Binary multiplier, Magnitude comparator, Multiplexers, Demultiplexers, Decoders, Encoders.

UNIT III

Sequential Logic And Its Applications: Storage elements: latches & flip flops, Characteristic Equations of Flip Flops, Flip Flop Conversion, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters: Johnson & Ring Counter.

UNIT IV

Synchronous & Asynchronous Sequential Circuits: Analysis of clocked sequential circuits with state machine designing, State reduction and assignments, Design procedure. Analysis procedure of Asynchronous sequential circuits, circuit with latches, design procedure, Reduction of state and flow table, Race-free state assignment, Hazards.

UNIT V

Memory & Programmable Logic Devices: Digital Logic Families: DTL, DCTL, TTL, ECL & CMOS etc., Fan Out, Fan in, Noise Margin; RAM, ROM, PLA, PAL; Circuits of Logic Families, Interfacing of Digital Logic Families, Circuit Implementation using ROM, PLA and PAL; CPLD and FPGA.

Text Books:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", Pearson Education.
2. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press.
3. RP Jain, "Modern Digital Electronics", Tata McGraw Hill Publication.

Reference Books:

1. DP Kothari and J.S. Dhillon, "Digital Circuits and Design", Pearson Education.
2. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI Learning Pvt. Ltd.

REC302: ELECTRONIC DEVICES AND CIRCUITS

UNIT I

Energy Bands and Charge Carrier in Semiconductor: Bonding forces and energy bands in solids, Charge Carriers in Semiconductors, Carrier Concentrations, Drift Mechanism.
Excess carriers in Semiconductors: Optical Absorption, Carrier Lifetime: Direct Recombination, Steady State Carrier Generation, Quasi-Fermi Level, Diffusion of carriers and Einstein relation.

UNIT II

Junctions: Equilibrium Conditions, Forward and Reveres Biased Junctions; Steady State Conditions.
Optoelectronic Devices: Photodiode V-I characteristic, Photodetector, Solar Cells, Light Emitting Diode.

UNIT III

MOSFET: Device structure and its operation in equilibrium, V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier

UNIT IV

BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.

UNIT V

Feedback: The general feedback structure, properties of negative feedback, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier.
Oscillators: Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator.

Text Book:

1. AS Sedra and K. C. Smith, “Microelectronic Circuits”, Oxford University Press.
2. Millman Jacob, Christos Halkias , Satyabrata Jit, “Electronic Devices and Circuits”, Tata McGraw Hill.
3. BG Streetman and S. Banerjee “Solid State Electronics Devices”, Prentice Hall of India.

Reference Books:

1. Donald A. Neamen “Semiconductor Physics & Devices”, Tata McGraw Hill.
2. Alok K. Dutta, “Semiconductor Devices and Circuits”, Oxford University Press.
3. Jacob Millman and Arvin Grabel, “Microelectronics”, Tata McGraw Hill.

REC303: SIGNALS & SYSTEMS

UNIT I

Signals: Representation of Signals, Singularity Functions, Discrete Time Signals, Types of Signals, Time Scaling and Shifting, Convolution and Correlation of LTI Systems, Correlation of energy and power signals.

UNIT II

Systems and Analysis of System: System Classification, Linearity/Time Invariance, Causal System, Characterization of LTI Systems, Unit Sample Response, Generalization of D.T. Systems, Concept of Stability, Convolution Integrals/summations, Energy and Power spectral density, Properties of Power spectral Density, Analysis of First order systems, Analysis of second order systems.

UNIT III

Fourier Transforms: Properties and Significance of CTFT, CTFT of Common Signals, Inverse CTFT; Introduction to DTFT, DTFT of Common Signals, Theorems and Properties – DTFT, Inverse DTFT; Continuous Time and Discrete Time Hilbert Transform and its Properties. Introduction of Gaussian signal and its Fourier transform.

UNIT IV

Laplace Transform and Z Transform: Laplace Transforms- Introduction, Laplace Transforms of common signals, Theorems and properties of Laplace Transforms, Concept of Region of Convergence, Inverse Laplace Transforms; Z Transforms – Introduction, Z Transforms of Common Signals, Theorems and properties of Z Transforms, Inverse Z Transforms.

UNIT V

Sampling of Time Signals: Nyquist Criterion, Sampling theorem and frequency domain representation of sampling, Sampling Techniques, Reconstruction of band limited signal from its samples, Sampling of Sinusoidal and other signals.

Text Book:

1. AV Oppenheim, A.S. Willsky and S. Hamid Nawab, 'Signals and Systems', Pearson Education.
2. TK Rawat, "Signals and Systems", Oxford University Press.

Reference Books:

1. BP Lathi, "Principals of Linear Systems and Signals", Oxford University Press.
2. P. Ramakrishna Rao, 'Signal and System', Tata McGraw Hill, New Delhi.
3. Kishore S. Trivedi, "Probability & Statistics with Reliability Queuing and Computer Science Applications", Wiley Publication.

REC351: DIGITAL LOGIC DESIGN LAB

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, Concept of V_{cc} and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of Decoder using logic gates.
5. Implementation and verification of Encoder using logic gates.
6. Implementation of 4:1 multiplexer using logic gates.
7. Implementation of 1:4 demultiplexer using logic gates.
8. Implementation of 4-bit parallel adder using 7483 IC.
9. Design, and verify the 4-bit synchronous counter.
10. Design, and verify the 4-bit asynchronous counter.
11. Implementation of Mini Project using digital integrated circuit's and other components.

REC352: ELECTRONIC DEVICES AND CIRCUITS LAB

1. **Study of Lab Equipments and Components:** CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. **P-N Junction diode:** Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
3. **Applications of PN Junction diode:** Half & Full wave rectifier- Measurement of V_{rms}, V_{dc}, and ripple factor.
4. **Characteristics of Zener diode:** V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance..
5. **Application of Zener diode:** Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.
6. **Characteristic of BJT:** BJT in CE configuration- Graphical measurement of h-parameters from input and output characteristics. Measurement of A_v, A_I, R_o and R_i of CE amplifier with potential divider biasing.
7. **Measurement of Operational Amplifier Parameters:** Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.
8. **Applications of Op-amp:** Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator.
9. **Field Effect Transistors:** Single stage Common source FET amplifier –plot of gain in dB Vs frequency, Measurement of, bandwidth, input impedance, maximum signal handling capacity (MSHC) of an amplifier.
10. **Oscillators:** Sinusoidal Oscillators-
    a. Wein's bridge oscillator
    b. phase shift oscillator.
11. Simulation of Amplifier circuits studied in the lab using any available simulation software and measurement of bandwidth and other parameters with the help of simulation software.

REC353: SIGNALS & SYSTEMS LAB

1. Introduction to MATLAB
    a. To define and use variables and functions in MATLAB.
    b. To define and use Vectors and Matrices in MATLAB.
    c. To study various MATLAB arithmetic operators and mathematical functions.
    d. To create and use m-files.
2. Basic plotting of signals
    a. To study various MATLAB commands for creating two- and three-dimensional plots.
    b. Write a MATLAB program to plot the following Continuous time and discrete time signals
        1. Step Function
        2. Impulse Function
        3. Exponential Function
        4. Ramp Function
        5. Sine Function
3. Time and Amplitude transformations
    a. Write a MATLAB program to perform amplitude-scaling, time-scaling and time-shifting on a given signal.
4. Convolution of given signals
    a. Write a MATLAB program to obtain linear convolution of the given sequences.
5. Autocorrelation and Cross-correlation
    a. Write a MATLAB program to compute autocorrelation of a sequence x(n) and verify the property.
    b. Write a MATLAB program to compute cross-correlation of sequences x(n) and y(n) and verify the property.
6. Fourier Series and Gibbs Phenomenon
    a. To calculate Fourier Series coefficients associated with Square Wave.
    b. To Sum the first 10 terms and plot the Fourier Series as a function of time
    c. To Sum the first 50 terms and plot the Fourier Series as a function of time
7. Calculating transforms using MATLAB
    a. Calculate and plot Fourier Transform of a given signal
    b. Calculate and plot Z-transform of a given signal
8. Impulse response and Step response of a given system
    a. Write a MATLAB program to find the impulse response and step response of a system form its difference equation
    b. Compute and plot the response of a given system to a given input
9. Pole-zero diagram and bode diagram
    a. Write a MATLAB program to find pole-zero diagram, bode diagram of a given system from the given system function
    b. Write a MATLAB program to find, bode diagram of a given system from the given system function
10. Frequency response of a system
    a. Write a MATLAB program to plot magnitude and phase response of a given system
11. Checking Linearity/Non-Linearity of a system using SIMULINK
    a. Build a system that amplifies a sine wave by a factor of two.
    b. Test the linearity of this system using SIMULINK

References:

1. "Digital Signal Processing Using MATLAB" ,Vinay K. Ingle ,John G. Proakis, Cengage Learning
2. Mathworks Website www.mathworks.com/
3. Virtual Lab Website http://www.vlab.co.in/, http://iitg.vlab.co.in/?sub=59&brch=166

REC354: ELECTRONICS WORKSHOP & PCB DESIGN LAB

1. Study of CRO, DMM & Function Generator.
2. Study of various types of Active & Passive Components based on their ratings.
3. Winding shop: Step down transformer winding of less than 5VA.
4. Soldering shop: Fabrication of DC regulated power supply
5. Identification of various types of Printed Circuit Boards (PCB) and soldering Techniques.
6. Introduction to PCB Design software
7. PCB Lab: a. Artwork & printing of a simple PCB.
   b. Etching & drilling of PCB.
8. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.

RCS406: DATA STRUCTURE & ALGORITHMS

UNIT I

Abstract Data Types, Sequences as value definitions, Data types in C, Pointers in C, Data Structures and C, Arrays in C, Array as ADT, One Dimensional Array, Implementing one Dimensional Array, Array as parameters, Two Dimensional Array, Structures in C, Implementing Structures, Unions in C, Implementation of unions, Structure Parameters, Allocation of storage and scope of variables, Recursive Definition and Processes: Factorial Function, Fibonacci Sequence, Recursion in C, efficiency of Recursion, Hashing: Hash Function, Open Hashing, Closed Hashing: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT II

Stack, Queue And Linked List: Stack definition and examples, Primitive Operations, Example Representing Stacks in C, Push And Pop Operation Implementation, Queue as ADT, C Implementation of Queues, Insert Operation, Priority Queue, Array Implementation of Priority Queue, Inserting and Removing Nodes from a list-linked Implementation of stack, Queue and Priority Queue, Other List Structures, Circular Lists: Stack and Queue as Circular List -Primitive Operations on circular lists, Header Nodes, Doubly Linked Lists, Addition of Long Positive Integers on Circular and Doubly Linked List.

UNIT III

Trees: Binary trees: Operations on Binary Trees, Applications of Binary Trees, Binary Tree Representation, Node Representation of Binary Trees, Implicit Array Representation of Binary Tree, Binary Tree Traversal in C, Threaded Binary Tree, Representing List as Binary Tree, Finding the Kth element, Deleting an Element, Trees and their applications: C Representation of trees, Tree Traversals, Evaluating an Expression Tree, Constructing a Tree.

UNIT IV

Sorting And Searching: General Background of Sorting: Efficiency Considerations, Notations, Efficiency of Sorting, Exchange Sorts: Bubble Sort; Quick Sort; Selection Sort; Binary Tree Sort; Heap Sort, Heap as a Priority Queue, Sorting Using a Heap, Heap Sort Procedure, Insertion Sorts: Simple Insertion, Shell Sort, Address Calculation Sort, Merge Sort, Radix Sort, Sequential Search: Indexed Sequential Search, Binary Search, Interpolation Search.

UNIT V

Graphs: Application of Graph, C Representation of Graphs, Transitive Closure, Warshall's Algorithm, Shortest Path Algorithm, Linked Representation of Graphs, Dijkstra's Algorithm, Graph Traversal, Traversal Methods for Graphs, Spanning Forests, Undirected Graph and their Traversals, Depth First Traversal, Application of Depth First Traversal, Efficiency of Depth First Traversal, Breadth First Traversal, Minimum Spanning Tree, Kruskal's Algorithm, Round Robin Algorithm.

Text Book:

1. Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, “Data structures using C and C++”, Pearson Education.
2. Reema Theraja, “Data Structure using C”, OUP Publication.

References Books:

1. E. Balagurusamy, “Programming in ANSI C', Second Edition, Tata McGraw Hill Publication.
2. Robert L. Kruse, Bruce P. Leung Clovis L. Tondo, “Data Structures and Program Design in C”, Pearson Education.
3. Lipschutz, “Data Structures With C”, Tata McGraw-Hill Education.
4. TH Koreman, “Introduction to Algorithms“, MIT Press.

REC401: MICROPROCESSORS & MICROCONTROLLERS

UNIT I

8085 MICROPROCESSOR: History and Evolution of Microprocessor and their Classification, Architecture of 8085 Microprocessor, Address / Data Bus multiplexing and demultiplexing. Status and Control signal generation, Instruction set of 8085 Microprocessor, Classification of instructions, addressing modes, timing diagram of the instructions.

UNIT II

Hardware Interfacing with 8085: Methods of data Transfer and Interrupts of 8085 microprocessor: Classification of interrupts, Programming using interrupts, Direct Memory Access, Serial and parallel data transfer, Interfacing of Memory Chips with 8085 Microprocessor, Interfacing of 8085 with 8155/8156 (RAM), 8355/8755 (ROM). Interfacing of Programmable Devices with 8085 Microprocessor, 8279 programmable Keyboard/Display interface, 8255A programmable Parallel interface, 8254 programmable Interval Timer, 8259A programmable Interrupt Controller, Assembly language programming.

UNIT III

16-bit low power MCU MSP430: Introduction to microcontrollers and embedded systems, Von Neumann (Princeton) and Harvard architecture, RISC and CISC machine, Introduction to MSP430: Architecture, Programming Techniques, Addressing Modes, Programming System registers and configuration I/O ports pull up/down registers concepts, Low Power aspects of MSP430: low power modes, Active vs Standby current consumption.

UNIT IV

Configuring Peripherals in MSP430: External interrupts and software interrupt, interrupt programming, Watchdog timer, Clock Tree in MSP430, Timer/ counter interrupt, Programming MSP430 timer, counter programming, Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.

UNIT V

Serial Communication Interfaces in MSP430: Basics of serial communication, mode of serial communication, RS232, serial communication issue, Serial port programming. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices, external memory, keyboards, display devices, DAC/ADC, DC Motor, Stepper Motor, Servomotor, power management, Sensor Interfacing and signal conditioning.
Case Study: MSP430 based embedded system application using the interface protocols for communication with external devices: "A Low-Power Battery less Wireless Temperature and Humidity Sensor with Passive Low Frequency RFID.

Text Book:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publication (India) Pvt. Ltd.
2. DV Hall, "Microprocessors Interfacing", Tata McGraw Hill Publication.
3. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press Publication.
4. Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880

5. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN-13: 978-0750682763

Reference Books:

1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training
3. AK Roy & KM Bhurchandi, “Advance Microprocessor and Peripherals (Architecture, Programming & Interfacing)”, Tata McGraw Hill Publication.

REC402: ELECTROMAGNETIC FIELD THEORY

UNIT I

Coordinate Systems and Transformation :

Basics of Vectors: Addition, subtraction and multiplications**;** Cartesian, Cylindrical, Spherical transformation.

Vector calculus: Differential length, area and volume, line surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.

UNIT II

Electrostatic fields: Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses' Law- Maxwell's equation, Electric dipole and flux line, Energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, Dielectric-constants, Continuity equation and relaxation time, boundary conditions, Electrostatic boundary value problems: Poisson's and Laplace's equations., Methods of Images.

UNIT III

Magneto statics : Magneto-static fields, Biot - Savart's Law, Ampere's circuit law, Maxwell's equation, Application of ampere's law, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential.

UNIT IV

Magnetic forces: Materials and devices, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy.

UNIT V

Waves and Applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, Displacement current, Maxwell's equation in final form
Electromagnetic wave propagation: Wave propagation in loss dielectrics, Plane waves in lossless dielectrics Plane wave in free space. Plain waves in good conductors, Power and the pointing vector, Reflection of a plain wave in a normal incidence. Transmission Lines and Smith Chart.

Text Book:

1. MNO Sadiku, "Elements of Electromagnetic', Oxford University Press.

Reference Books:

1. WH Hayt and JA Buck, "Engineering Electromagnetic", McGraw- Hill Education.

REC403: ELECTRONIC MEASUREMENT AND INSTRUMENTATION

UNIT I

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimensions and standards.

Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis.

PMMC instrument, Galvanometer, DC ammeter, DC voltmeter, series ohm meter.

UNIT II

Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes, Digital voltmeter systems, Digital multimeter, digital frequency meter System.

UNIT III

Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, Low Resistance Measuring Instruments, AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

UNIT IV

CRO: CRT, Wave Form Display, Time Base, Dual Trace Oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications.

UNIT V

Instrument calibration: Comparison method, digital multimeter as standard instrument, calibration instrument, Recorders: X-Y recorders, plotters Transducers.

Text Book:

1. David A. Bell, “Electronic Instrumentation and Measurements”, Oxford University Press.

Reference Books:

1. Oliver and Cage, “Electronic Measurements and Instrumentation”, Tata McGraw Hill Publication.
2. Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Buterworth Heinmann).

REC451: MICROPROCESSORS AND MICROCONTROLLERS LAB

1. To study 8085 microprocessor system.
2. i) Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
   ii) Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
   iii) To perform multiplication and division of two 8 bit numbers using 8085.
3. Learn and understand how to configure MSP-EXP430G2 Launchpad digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).

   Exercises:

   a) Modify the delay with which the LED blinks.
   b) Modify the code to make the green LED blink.
   c) Modify the code to make the green and red LEDs blink:
      i. Together
      ii. Alternately

   d) Alter the code to turn the LED ON when the button is pressed and OFF when it is released.

   e). Alter the code to make the green LED stay ON for around 1 second every time the button is pressed.

   f). Alter the code to turn the red LED ON when the button is pressed and the green LED ON when the button is released.
4. Usage of Low Power Modes:

   Configure the MSP-EXP430G2 Launchpad for Low Power Mode (LPM3) and measure current consumption both in active and low power modes. Use MSPEXP430FR5969 as hardware platform and measure active mode and standby mode current.

   Exercises:

   a) How many Low power modes are supported by the MSP430G2553 platform?

   b) Measure the Active and Standby Current consumption in LPM3 mode for the same application using MSP430F5529 LaunchPad
5. Learn and understand GPIO based Interrupt programming. Write a C program and associated GPIO ISR using interrupt programming technique.

   Exercises:

   a) Write the code to enable a Timer interrupt for the pin P1.1.
   b) Write the code to turn on interrupts globally
6. Implement Pulse Width Modulation to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.

   Exercises:

   a) Observe the PWM waveform on a particular pin using CRO.
   b) What is the maximum resolution of PWM circuitry in MSP430G2 Launchpad?
   c) Change the above code to create a PWM signal of 75% duty cycle on particular PWM pin.
7. The main objective of this experiment is to control the on-board, red LED by the analog input from a potentiometer. This experiment will help you to learn and understand how to configure an ADC to interface with a potentiometer.

Exercises:

a) Alter the threshold to 75% of Vcc for the LED to turn on.

b) Modify the code to change the Reference Voltage from Vcc to 2.5V.

8. Learn and understand how to configure the PWM and ADC modules of the MSP-EXP430G2 Launchpad to control the DC motor using external analog input.

   Exercises:

   a) What is the maximum resolution of PWM circuitry in MSP430G2 LaunchPad and how it can be achieved using program?
   b) Create a PWM signal of 75% duty cycle on particular PWM pin.
   c) Create Switch case code from the example code to run the DC Motor in 3 set of speeds.

9. Understand the ULP Advisor capabilities and usage of ULP Advisor to create optimized, power-efficient applications on the MSP-EXP430G2 Launchpad.

   Exercises:

   a) How does the ULP Advisor software help in designing power-optimized code?
   b) Which ULP rule violation helps us to detect a loop counting violation?
   c) Connect the MSP430 to terminal on PC and echo back the data

10. Configure of Universal Serial Communication Interface (USCI) module of MSP430G2553 for UART based serial communication. The main objective of this experiment is to use UART of the MSP430G2553 to communicate with the computer.

    Exercise:

    Modify the above code to transmit the set of strings to the serial terminal via UART as shown below:

    char str1[]="MSP430G2 launchpad"

    char str2[]= "Ultra low power mixed signal processing applications"

11. Understand and Configure 2 MSP430F5529 Launchpads in master-slave communication mode for SPI protocol.

    Exercises:

    a) Which port pins of MSP430 can be configured for SPI communication?

    b) What is the data transfer rate supported by MSP430 for SPI communication?

REC452: ADVANCED ELECTRONICS SYSTEM LAB

Transistor Modeling and Circuits

- Metal Oxide Semiconductor Field Effect Transistors (MOSFETs)
    - *DC biasing of Common Source
    - *MOSFET Common Source Amplifier
    - *MOSFET Source Follower
    - *Current Mirror
- SPICE parameters for MOSFET transistors.
- Step-Down (Buck) DC-DC Converters.
- Step-Up (Boost) DC-DC Converter
- CMOS Amplifier design.

Timing

- -MOSFET based Ring oscillators
- -MOSFET based Relaxation oscillators
- MOSFET based Voltage-controlled oscillators
- Integration of crystal oscillator into circuits

Data Conversion

- Analog to Digital Conversion
    - * Successive Approximation ADC
- Digital to Analog Conversion
    - * Scaled Resistor Network

System Considerations

- System-level stability: decoupling, ground loops
- Basics of EMC and screening
- Examples of complete electronic systems

REC453: ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB

1. Study of semiconductor diode voltmeter and its use as DC average responding AC voltmeter.
2. Study of L.C.R. Bridge and determination of the value of the given components.
3. Study of distortion factor meter and determination of the % distortion of the given scillator.
4. Study of the transistor tester and determination of the parameters of the given transistors.
5. Study of the following transducer (i) PT-100 transducer (ii) J- type transducer (iii) K-type transducer (iv) Pressure transducer
6. Measurement of phase difference and frequency using CRO (Lissajous Figure)
7. Measurement of low resistance Kelvin's double bridge.
8. To measure unknown capacitance of small capacitors by using Schering's bridge.
9. To measure unknown Inductance using Hay's bridge.
10. To measure unknown frequency using Wein's frequency bridge.

RCS456: DATA STRUCTURE AND ALGORITHMS LAB

1. Run time analysis of Fibonacci Series
2. Study and Application of various data Structure
3. Study and Implementation of Array Based Program
   a. Searching (Linear Search, Binary Search)
   b. Sorting (Bubble, Insertion, Selection, Quick, Merge etc)
   c. Merging
4. Implementation of Link List
   a. Creation of Singly link list, Doubly Linked list
   b. Concatenation of Link list
   c. Insertion and Deletion of node in link list
   d. Splitting the link list into two link list
5. Implementation of STACK and QUEUE with the help of
   a. Array
   b. Link List
6. Implementation of Binary Tree, Binary Search Tree, Height Balance Tree
7. Write a program to simulate various traversing Technique
8. Representation and Implementation of Graph
   a. Depth First Search
   b. Breadth First Search
   c. Prim`s Algorithm
   d. Kruskal`s Algorithms
9. Implementation of Hash Table

4th Year VII-SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	NOE071 to 074	Open Elective-I	3-1-0	100	30	20	150	4
2.	NPE701	Water Flooding and Enhanced Oil Recovery	3-0-0	100	30	20	150	3
3.	NPE702	Offshore Drilling and Petroleum Production Practices	3-1-0	100	30	20	150	4
4.	NPE031 to 034	Departmental Elective-III	3-1-0	100	30	20	150	4
5.	NPE041 to 044	Departmental Elective-IV	3-1-0	100	30	20	150	4
6.	NPE751	Petroleum/Oilfield Equipment Design Drawing	0-0-3	30		20	50	2
7.	NPE752	Industrial Training	0-0-2			50	50	1
8.	NPE753	Project	0-0-6			100	100	3
9.	NGP701	GP				50	50	
Total							1000	25

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

Open Elective-I:

a. NOE071 Entrepreneurship Development
b. NOE072 Quality Management
c. NOE073 Operations Research
d. NOE074 Introduction to Biotechnology

Departmental Elective-III:

a. NPE031 Petroleum Formation Evaluation
b. NPE032 Corrosion Technology in Petroleum
c. NPE033 Refinery Losses
d. NPE034 Petroleum Product Economics

Departmental Elective-IV:

a. NPE041 Distillation Process
b. NPE042 Multi Component Separation
c. NPE043 Advanced Geo Physics
d. NPE044 Supply Chain Management

4th Year VIII-SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	NOE081 to 084	Open Elective-II	3-1-0	100	30	20	150	4
2.	NPE801	Health safety & Environment Management in Petroleum Industry	3-1-0	100	30	20	150	4
4.	NPE051 to 054	Departmental Elective-V	3-1-0	100	30	20	150	4
5.	NPE061 to 064	Departmental Elective-VI	3-1-0	100	30	20	150	4
6.	NPE851	Seminar	0-0-3			50	50	2
8.	NPE852	Project	0-0-12	100		200	300	7
9.	NGP801	GP				50	50	
Total							1000	25

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

Open Elective-II:

a. NOE081 Non Conventional Energy Resources
b. NOE082 Nonlinear Dynamic Systems
c. NOE083 Product Development
d. NOE084 Automation & Robotics

Departmental Elective-V:

a. NPE051 Coal Bed Methane and Gas Hydrates
b. NPE052 Deep Sea Production System
c. NPE053 Surface Operations For Oil & Gas Production
d. NPE054 Design of Catalytic Systems in Petroleum Engineering

Departmental Elective-VI:

a. NPE061 Chemical Reaction Kinetics
b. NPE062 Hazards Management
c. NPE063 Process Equipment and Piping Design
d. NPE064 Storage and Transportation of Crude Oil and Natural gas

NPE701: WATER FLOODING AND ENHANCED OIL RECOVERY

UNIT I

Enhanced oil recovery methods – Definition – Schematic representation of enhanced oil Recovery – Techniques involved in EOR – Chemical flooding – Hydrocarbon or Gas injection – Thermal recovery methods.

UNIT II

Chemical oil recovery methods – Polymer, surfactant/polymer and alkaline flooding – Carbon dioxide (CO2) flooding.

UNIT III

Thermal recovery – fire flooding – steam flooding – mechanism of hydrocarbon miscible flooding
– mechanism of nitrogen and flue gas flooding – mechanism of CO2 flooding – Mechanism of surfactant/polymer flooding – Mechanism of alkaline flooding – Mechanism of steam flooding.

UNIT IV

Criteria for gas injection - Criteria for chemical methods – criteria for thermal methods. Microbial EOR methods (MEOR).

UNIT V

Laboratory design for EOR – Preliminary test – Water analysis – Oil analysis – Core testing – Viscosity testing.

BOOKS:

1. Von Pollen. H.K. and Associates. Inc., “Fundamentals of Enhanced oil Recovery” – Penn Well publishing co., Tulsa (1980)
2. Latil M. et al., “Enhanced oil recovery” – Gulf publishing co. Houston (1980)
3. Standard Hand Book of Petroleum & Natural Gas Engineering” – 2nd Edition 2005-William C. Lyons & Gary J. Plisga-Gulf professional publishing comp (Elsevier).

NPE702: OFFSHORE DRILLING AND PETROLEUM PRODUCTION PRACTICES

UNIT I

Introduction to offshore oil and gas operations.Sea States and Weather: Meteorology, oceanography, ice, sea bed soil. Buoyancy and stability.

UNIT II

Offshore Fixed Platforms: Types, description and operations.
Offshore Mobile Units: Types, description and installation. Station keeping methods like conventional mooring & dynamic positioning system.
Offshore Drilling: Difference in drilling from land, from fixed platform, jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling.

UNIT III

Offshore Well Completion - Platforms and subsea completions, Deep water applications of subsea technology.
Offshore Production: Oil processing platforms, gas processing platforms, water injection platforms, storage, SPM and SBM, transportation and utilities.

UNIT IV

Deep water technology: Introduction, definition & prospects. Deep water regions, Deep water drilling rig – selection and deployment, Deep water production system, Emerging deep water technologies – special equipment and systems, Remote operation vessels (ROV).

UNIT V

Divers and Safety: Principles of diving use of decompression chambers, life boats. Offshore Environmental Pollution and Remedial Measures.

BOOKS:

1. Standard Hand Book of Petroleum & Natural Gas Engineering" – 2nd Edition 2005-William C.Lyons & Gary Gulf-Gulf professional publishing comp (Elsevier).
2. Wellsite Geological Techniques for petroleum Exploration by Sahay.B et al.
3. Petroleum Exploration Hand Book by Moody, G.B.

NPE031: PETROLEUM FORMATION EVALUATION

UNIT I
Petrophysical measurements to sub-surface engineering.

UNIT II
Indirect Methods: SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.

UNIT III
Production Logging: Introduction, type of tools, principles, limitations and applications.

UNIT IV
Special Type of Logging Tools: Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), NMR logging principles. Logging in high-angle wells.

UNIT V
Log Interpretation and Analysis Techniques.Standard log interpretation methods.Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.Clean sand interpretationConcepts of invasion – RXO, Tornado charts.Shaly sand interpretation

NPE032: CORROSION TECHNOLOGY IN PETROLEUM

UNIT I

Corrosion in oil and gas production. Introduction to corrosion control. Definitions: Materials involved. Basic corrosion principles, corrosion rate. Electrochemical reactions. Electrode potentials-passivity-temperature-pressure-velocity-conductivity-pH-dissolved gases.

UNIT II

Forms of corrosion-uniform-pitting-Galvanic erosion-Intergranualar and weld corrosion, selective Leaching, stress corrosion. Hydrogen embitterment-Fatigue. Role of oxygen in oil filed corrosion-downhole and surface equipment-water flood Removal of oxygen, analysis and criteria for control.

UNIT III

Role of carbon dioxide (CO2) in corrosion-Effect of temperature and pressure Corrosion of well tubing and other equipments. Role of hydrogen sulphide (H2S)-Corrosion in downhole, surface, storage and pipelines.

UNIT IV

Corrosion prevention-Cathodic protection. Principles of operation-applications Galvanic systems, corrosion prevention-coatings-corrosion prevention inhibitors-types of corrosion inhibitors-choice and selection.

UNIT V

Oil treatment corrosion-crude oil properties-desalting-distillation and other processing case histories, sweetening processes-subsea systems corrosion. Inspection and corrosion monitoring case history-oil storage tank corrosion-Oilfield and oil treating facilities-offshore platforms-down hole equipments.

BOOKS:

1. “Corrosion control in Petroleum production”-TPC 5-2-nd edition H.G.Byars Houston, texas, 1995.
2. Chemical engineering series, coulson and Richardson, Mc Graw Hill Publications.
3. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.

NPE033: REFINERY LOSSES

UNIT I

Heating of crude oil through exchangers, pipe still heaters, their type and constructional features, Estimation of heat duty, combustion calculation and heat transfer area in different parts in pipe still heater. Calculation of pressure drop and stack height.

UNIT II

Atmospheric distillation, Principles and mode of excess heat removal flash zone calculation and estimation side draw temperatures. Design aspects. Posatmospheric distillation, t treatment of straight run products.

UNIT III

Vacuum distillation Column internals and operational aspects for lubes and asphalt's Cracking feed stocks.

UNIT IV

Pressure distillation and gas fractionating units. Difference between various types of distillation Regaining of products of pressure distillations**.**

UNIT V

Lubrication oils, Specifications, characteristics, Production lube specialties, additives, Refining of lubrication oil-solvent chemical and hydrogenation method dew axing, deasphalting etc. Asphalt and asphalt specialties. Air blowing and emulsification techniques.

BOOKS:

1. B.K. Bhaskar Rao., "Modern Petroleum Refining Processes", 2nd Ed., Oxford and IBH publishing Co. Pvt. Ltd., New Delhi 1990.
2. W.C. Edmister "Applied Hydrocarbon Thermodynamics", Gulf Publishing, Houstan, Texas 1961.
3. W.L. Nelson, "Petroleum Refinery Engineering", McGraw-Hill, 1964.
4. M.V. Winkle, "Distillation, Chemical Engineering series", McGraw-Hill, 1961

NPE034: PETROLEUM PRODUCT ECONOMICS

UNIT I

Supply and demand curves, the elasticity of supply and demand, public finance concepts such as consumer surplus, excise and export taxes. Forecasting techniques for the energy industry, including energy prices. Demand and supply for natural gas, cured oil and pipeline transportation, determinants of energy demand, energy markets, energy pricing, stability and performance of energy markets.

UNIT II

The economics of investment, Discounted cash flow analysis, Cost Benefit Analyses, Internal Rate of Return, NPV, Profitability Index, Natural Monopoly theory, National competition Policy, Gas Market Regulation, taxation of the oil and gas industry, government policy and trade permits, Monte Carlo analysis, Net Back Pricing, Transfer Pricing and regulatory aspects.

UNIT III

Application of petroleum engineering principles and economics to the evaluation of oil and gas projects, evaluation principles, time value of money concepts, investment measures, cost estimation, price and production forecasting, risk and uncertainty, project selection and capital budgeting inflation, escalation, operating costs, depreciation, cost recovery.

UNIT IV

Petroleum exploration and production contracts. Sharing of the economic rent, portfolio management. Value creation, Corporate finance & return on capital, economic appraisal methods for oil filed development, reservoir model costs and calculations.

UNIT V

Case studies: Economic study of an oil filed development project, petrochemical plant project, natural gas break even price, natural gas liquefaction cost, LGN transport cost, investment profitability study for a gas pipeline.

BOOKS:

1. Industrial Economics – An Introductory Textbook. R.R.Barthwal, 2nd Edition, New Age International Publisher.
2. Managerial Economics – D.N.Divedi. 6th Revised Edition. Vikas Publishing House Private Ltd.
3. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary, C Plisga. Gulf Professional Publishing.
4. Petroleum Engineering Handbook. Bradely, H.B. Society of Petroleum Engineers. Richardson. Texas.
5. The Encyclopedia Americana, International Edition Volume 9, Grolier Incorporated.

NPE041: DISTILLATION PROCESS

UNIT I
Nature, origin and distribution of oil shale. Petrology and geochemistry of oil shale.

UNIT II
Oil shale retorting and extraction process. Characterization of oil shale. Supercritical extraction oil from shale.

UNIT III
Mathematical modeling of oil shale pyrolysis. Economic factor of shale oil production.

UNIT IV
History of shale gas production. Extraction methods: development of current practices. Location an dsize of production areas: estimated reserves and economics.

UNIT V
Environmental issues in shale gas exploration. Shale gas markets and globus impact on energy scenario.

NPE042: MUTI COMPONENT SEPARATION

UNIT I

Introduction to the Fundamentals of Distillation. Multi component flash calculation, Isothermal flash calculation, Adiabatic flash calculation.

UNIT II

Approximate methods for multi component – multistage separation, Design methods and simulation methods for multistage contactor Fenske – Underwood – Gilliland (FUG) method for distillation.

UNIT III

Multistage counter-current cascade – Group method for absorber and stripper Rigorous method for multi component – multistage separation Introduction to MESH equation

UNIT IV

Historical development of different rigorous multi component distillation calculation method. Classification of different method based on solution scheme.

UNIT V

Thiele – Geddes method with theta (θ) method of convergence Wang and Henke tridiagonal matrix algorithm for complex distillation column

NPE043: ADVANCED GEO PHYSICS

UNIT I

Physical Basis of Geophysical exploration – Various surface and sub surface methods and their classifications – Physical Properties of rocks and minerals exploited in exploration and factors that control them Geophysical anomalies

UNIT II

Gravity Prospecting – Principles – Earth Gravitational Field Units – Variations in the Gravitational field – Newton's Law – Geoid , Spheroid and normal gravity field – Absolute and relative measurement of Gravity – Gravimeters and their field operation – Field procedure – Interpretation of Gravity data and Applications of Gravity methods.

UNIT III

Radiometric Prospecting: Fundamentals of radioactivity – Rate of radioactivity decay – Successive disintegration and radioactive equilibrium – Natural radioactive elements – Radio active Series – Nature of radioactive emission – Artificial radioactivity – Radioactivity of rocks. Radiation measuring devices – Processing and Interpretation data – applications of radiometric methods.

UNIT IV

Seismic methods, fundamentals of elasticity – bulk modulus – Poisson's ratio – Elastic Seismic wave theory – Body and surface waves – Primary and Secondary waves – Seismic Instruments - Seismic channels – Applications of Seismic data – Interpretation of field data

UNIT V

Introduction to Well logging techniques – Well conditions – SP and Resistibility logging – Qualitative interpretation of SP and resistibility logs – applications.

BOOKS:

1. Introduction to Geophysics by Dobrin.
2. Principles of Geophysics by Ramachandran.
3. Quantitative Geophysics and Geology by Louis Lliboutry.
4. Principles of applied Geophysics by D.S. Paranis

NPE044: SUPPLY CHAIN MANAGEMENT

UNIT I

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing,organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II

Cultural, demographic factors, motives, types, buying decisions, segmentation factors demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

BOOKS:

1. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition 2007.
2. Philip Kolter, Koshy Jha, “Marketing Management”, Pearson Education ,Indian adapted edition.2007
3. Ramasamy and Nama Kumari, “Marketing Environment: Planning, implementation and control the Indian context”, 1990.
4. Czinkota & Kotabe, “Marketing management”, Thomson learning, Indian edition 2007
5. Adrain palmer, “ Introduction to marketing theory and practice”, Oxford university press IE 2004.
6. Donald S. Tull and Hawkins, “Marketing Research”, Prentice Hall of Inida-1997.
7. Philip Kotler and Gary Armstrong “Principles of Marketing”, Prentice Hall of India, 2000.
8. Steven J. Skinner, “Marketing”, All India Publishers and Distributes Ltd. 1998.
9. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007.

NPE751: PETROLEUM/ OILFIELD EQUIPMENT DESIGN DRAWING

1. Design of power transmission component.
2. Design of rotary pump / valve.
3. Design of pressure / reaction vessel.
4. Design of storage tank.
5. Design of heat exchanger..

NPE752: INDUSTRIAL TRAINNING

The students must submit the report to their institute complete 4 week Industrial Training after the completion of their 6th semester. Students may opt this course at any relevant Industry/Research Lab for 4 weeks.

NPE753/ NPE852: PROJECT

The students would be allotted an Industrial Project or any Research Project in the beginning of the VII semester itself. He/ She may continue this project in detail, later in the (8th) semester. The assessment of ESE will be done by the faculty member of the other department within the same institute.

NPE801: HEALTH SAFETY AND ENVIRONMENT MANAGEMENT IN PETROLEUM INDUSTRY

UNIT I

Toxicity, Physiological, Asphyxiation, respiratory and skin effect of Petroleum Hydrocarbons (including mixtures), sour gases (eg Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc.

UNIT II

Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).

UNIT III

Manual & automatic shut down system, blow down systems. Gas detection system. Fire detection and suppression systems.

UNIT IV

Personal protection systems & measures. HSE Policies, standards & specifications Disaster & crisis management.

UNIT V

Environment concepts, impact on eco-system, air, water and soil. The impact of drilling & production operations on environment, Environmental transport of petroleum wastes. Offshore environmental studies, offshore oil spill and oil spill control. Oil mines regulations and other environmental legislations. Environmental impact assessment. Waste treatment methods, waste disposal method, remediation of contaminated sites. Air & noise pollution.

NPE051: COAL BED METHANE AND GAS HYDRATES

UNIT I

Present status of coal bed methane. Formation and properties of coal bed methane. Thermodynamics of coal bed methane.

UNIT II

Exploration & Evaluation of CBM. Drilling, completion and logging of coal bed methane wells. Hydro-fracturing of coal seam, Activation of well. Production installation and surface facilities.

UNIT III

Well operation and production equipment. Treating and disposing produced water. Testing of coal bed methane wells.

UNIT IV

Introduction & present status of gas hydrates. Formation and properties of gas hydrates. Thermodynamics of gas hydrates. Exploration & evaluation of gas hydrates. Phase behavior of gas hydrates. Kinetics of gas hydrates.

UNIT V

Drilling and completion of gas hydrate wells. Prevention & control of gas hydrates. Gas hydrates accumulation in porous medium. Gas extraction from gas hydrates. Uses and application of gas hydrates.

NPE052: DEEP SEA PRODUCTION SYSTEM

UNIT I

Drilling and Well Servicing structures – Definitions – Design specifications – Maintenance and use of Drilling and wall servicing structures.

UNIT II

Hoisting Systems - Design – Rating and Testing – Inspections – Supplementary and Requirements – Manufacture and Tolerances.

UNIT III

Rotary Equipments - Swivel and Rotary Hose – Rotary Table and Bushing - Bits and Down hole tools.

UNIT IV

Mud Pumps – Pump installations – Pump operations – Drilling Muds and Completion fluids – Suspended solids and Transport Cuttings – Nonaqueous fluids – Oil base and synthetic – Base muds – Drilling fluids activities – Clay chemistry.

UNIT V

Drill strings – compositions and design – Drill Collar – Drill Pipe – Tools Joints –Drill String Design.

BOOKS:

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.
2. 1.Rabia.H. 'Oil Well Drilling Engineering, Principles And Practices' Graham And Trotman Ltd. 1985.
3. Mc.Cray. A.W and Cole.F.W. 'Oil Well Drilling Technology' University of Oklahoma Press, Norman 1959.

NPE053: SURFACE OPERATIONS FOR OIL & GAS PRODUCTION

Field Processing of Oil & Gas : Flash and stage separation of oil & gas; oil & gas separators, mist extractor, fluid level and pressure control system. Vertical and horizontal separators, metering separators. Working pressure and safety feature in oil & gas separators. Special problems in oil and gas separation. Removal of suspended solid & water from oil & gas. Scrubbers and wash tank. Demulsification and desalting.

Storage & Transport : Types & features of storage tanks Fixed roof and floating roof tanks. Specification, maintenance and operation of tank batteries, Vapour control and gravity conservation measures. Vapour recovery system. Metering of oil & gas, Sampling and Testing of crude oil. Gauging equipment and methods. Water and sediment determination. Orifice and other metering devices and their characteristics. EOR Processes (Surface facilities): Treatment of water for reservoir compatibility. Design consideration for water handling and injection system. Pumps types & sizing, Injectivity problems. Gas compression for injection, gas compressors. Design consideration for gas collection and distribution system for injection.

NPE054: DESIGN OF CATALYTIC SYSTEMS IN PETROLEUM ENGINEERING

A: Oil & Gas Field Development:

Development of Oil & Gas Fields : Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields. Production variants, performance prediction, Recovery factor, sample examples, Stages of preparation of development plans Sample examples & case studies. Computation of economic indices viz. Capital investment, payout period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields. Innovative ways to economize Asset development.

B: Design Oil and gas separation system. Heater-treater.

C: Artificial Lift Technology:

Basic principles and descriptions of Artificial lift methods : Gaslift - continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, hydraulic pumping – piston & jet type. **Design of Continuous gas lift system (pressure operated valves) -** graphical and analytical methods. Design of Intermittent gas lift system; single point injection standard tubing installation (Pressure operated valves) - graphical and analytical methods. Sucker rod pumping system, Centrifugal electric submersible pumping system. Design of Electrical submersible pumping system

NPE061: CHEMICAL REACTION KINETICS

Introduction to general modeling : Introduction to concept geological modeling. Types of model and designing of various models depending on reservoir complexities, rock properties, fluid properties – concept of back oil model, compositional model.

1. Overview: Introduction, Historical background, application of simulator, various types of models.
2. Flow Conditions: Single phase, two phase and multiphase flow equations for one, two and three dimension models.
3. Special Concept: Explicit and implicit, grid system, finite difference & finite element method, matrix solution, iterative method, stability criteria.
4. Data Preparation
5. Pesudo functions
6. Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation (IMPES), Implicit pressure and Implicit saturation (IMPIS).
7. Preview of numerical solution methods: Direct process, iterative process.
8. History Matching : Mechanics and parameters of match
9. Special Concept on Coning and Compositional Models simulation.
10. Optimization using Economic and Techno-economic evaluation: Computation of economic indices viz. different variants base on technical and economic consideration.
11. Introduction to streamline simulation & comparison of conventional/Streamline.

NPE062: HAZARDS MANAGEMENT

UNIT I

Geology and its perspectives. Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere - Elementary ideas of continental drift and plate tectonics - Evolution of ocean and continental basins.

UNIT II

Ecology, ecosystem and biotic communities, human impact on air, land, soil, water, climate and forest resources - conservation of resources, coping with natural hazards.

UNIT III

Natural Environmental Hazards: Various domains and classes of natural hazards- tropical cyclones, floods, landslides and earthquakes - Prediction control and awareness of earthquakes- volcanic types, distribution and causes - coastal erosion.

UNIT IV

Introduction to Environmental Hazards Management - Global Climate Change: Causes, trends, consequences, and management challenges- Mitigation measures of volcanoes, prevention and controls of landslides.

UNIT V

Environmental degradation and pollution - Air pollution - Water pollution and Soil pollution. Cyclones- types and effects - Droughts- types and factors contribution for drought - Floods- causes and forecast.

BOOKS:

1. Smith, K. Environmental Hazards: Assessing Risk and Reducing Disaster. Third Edition. 2001. Routledge Press.
2. Burton, I, R.W. Kates, and G.F. White, The Environment as Hazard, Second Edition. Guilford Press. 1993
3. Godschalk, et. al., Natural Hazard Mitigation: Recasting Disaster Policy and Planning. Island Press. 1999.

NPE063: PROCESS EQUIPMENT AND PIPING DESIGN

UNIT I

Detailed design and drawing of enclosures, supports and standard flanges, storage vessels including Unfired Pressure Vessels, Reaction Vessels.

UNIT II

Heat Exchangers: Detailed Design And Drawing of Various Types of Heat Exchangers.

UNIT III

Distillation Column: Detailed Design And Drawing of Distillation Column. Absorber: Detailed Design and Drawing of Absorber.

UNIT IV

Fundaments of fluid flow through pipes-Calculation of pressure drop for Newtonian & non-Newtonian fluids, incompressible & compressible fluids and two-phase flow, Calculation of Economic pipe diameter, insulation thickness, equivalent length, Slurry transport and pipelines Engineering flow diagram, nomenclature and equipment elevation.

UNIT V

Piping layout, line pressure drop, piping analysis, stress analysis of curved pipelines, yard piping, Piping codes, standards and specifications-ASME, ASTM, API Piping components-pipes, pipe ends, pipe fittings, end fittings, flanged joints, valves, valve codes and standards, valve classification, valve components, bolts, gaskets (fasteners and sealing).

NPE064: STORAGE AND TRANSPORTATION OF CRUDE OIL AND NATURAL GAS

UNIT I
Crude oil Trade, Selection of Port Location, Ship Building/Shipyards.

UNIT II
Commercial Sourcing of Natural Gas, Different Kinds of Regasification Techniques, Regasification Process & Cold Utilization, Synchronization of Degasified gas and Pipelines, Current Status in India.

UNIT III
Transportation techniques of crude oil, Pipeline specification, Corrosion Prevention techniques, Pressure drop, Pumps and Booster station, Wax deposition and prevention, Chemical treatment.

UNIT IV
Basic Engineering Aspects of Terminal Design, Design of Liquefaction Train, Ship Building/Shipyards, Storage Facilities.

UNIT V
Supply & Demand, Variation Gas Field & Aquifers, Technical Qualities and Storage, Properties of Storage Reservoir, Rocks & Fluids.
Flow through Storage Reservoir; Inventory Concept, Pressure- Content Hysteresis, Inventory Verification, Gas Flow Performance, Gas Deliverability.
Design & Development of Underground Storage Fields: Operation of Storage Fields. Threshold Pressure. Water Influx/Efflux Quantities. Aquifer Equilibrium Pressure. Error and Uncertainty. Gas Storage in Salt Cavity & Caverns: Thermodynamics, Temperature and Pressure Effect. Recent Developments.
Advanced Storage Techniques, Case Histories.

BOOKS:

1. Oilfield Processing: Crude Oil (Oilfield Processing of Petroleum R. Solvay, Pennwell Books 1995.
2. Advances in Environmental Control Technology: Storage Tank Paul Cheremisinoff Gulf Professional Publishing; 1ST edition (May 9, 1996)