

GOVERNMENT OF ANDHRA PRADESH



STATE BOARD OF TECHNICAL EDUCATION AND TRAINING
Andhra Pradesh :: Amaravathi



Globally Competitive
CURRICULUM (C-16)
For Polytechnic Diploma Courses
In Andhra Pradesh



**DIPLOMA IN
BIOMEDICAL ENGINEERING**

Front Cover Page

Objective of the New Curriculum (C-16)

To make the students 'Globally Competitive & Employable' by learning industry relevant subjects & undergoing Industrial training



Suggestions from Industrialists have been incorporated in the Curriculum by organising Industry Institute Interaction Meet.

Highlights of the Curriculum (C-16)



- ❖ 6 months /1 year industrial training in all the Diploma Courses.
- ❖ 1 year industrial training in collaboration with BOAT (Board of Apprenticeship & Training (SR), Chennai).
- ❖ Virtual labs for ECE & Computer Branches & Strengthening of Skill Development Centers to provide industrial training to students.

Fundamentals of 'Internet of Things' (IoT) is included for all the Branches in the Subject "Industrial Management & Smart Technologies".



"Communication Skills" and "Life Skills" have been introduced as practical subjects for all the Branches.



Front Cover Page-Inside



“Computer Fundamentals Laboratory” is introduced for all the Branches in First year. AutoCAD specific to the Branch has been given emphasis in the Curriculum.

C Language, Programmable Logic Controllers (PLC), Microcontrollers, Solar Energy are introduced in Electrical Engineering Branch.



Mobile Communications, Consumer Electronics are introduced in Electronics and Communication Branch

CAD/ CAM, CNC Machines, Power Plant Engineering are introduced in Mechanical Engineering Branch.



OOPS through JAVA, Web Designing, Computer Hardware & Networking are introduced in Computer Engineering Branch.

Automobile Chassis and Body Engineering, Recent Trends In Automobile Engineering, Motor Transport Organization etc are introduced in Automobile Engineering Branch.



Back Cover Page-Inside

Journal (JPAP)

The Department of
Technical Education,
A.P. has a bi- annual
'Journal of Polytechnics
of Andhra Pradesh'
JPAP



JOURNAL OF POLYTECHNICS IN ANDHRA PRADESH
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CISCO ACADEMIES IN POLYTECHNICS

- ◆ 70 Government Polytechnics chosen to have Cisco Academies
- ◆ Course Content of CISCO has been incorporated into the ECE and Computer Diploma Courses
- ◆ CISCO to train Staff of Polytechnics in two phases to enable them to run the courses effectively
- ◆ Students to get 'Certificate from CISCO' along with Diploma Certificate.

CURRICULUM – 2016(C – 16)

**CURRICULUM-2016
(C-16)**

FOR DIPLOMA COURSES IN ANDHRA PRADESH

PREAMBLE

The State Board of Technical Education and Training, Andhra Pradesh under the aegis of the Department of Technical Education, Andhra Pradesh generally reviews the Curricula once in every five years. However, recognizing the needs of the industries and enhancing the employability skills of Polytechnic students, the Government of Andhra Pradesh constituted a committee vide G.O.Rt.No:95 of Higher Education (TE) Dept dated: 29-4-2016 and G.O.Rt.No:98 of Higher Education (TE) Dept dated: 4-5-2016 for updation of polytechnic curriculum under the chairmanship of Sri. S. Balasubrahmanyam, IAS (Retd.,). The committee submitted a report on 31-5-2016 making certain recommendations and suggesting new initiatives to be incorporated in the curriculum. An Industry Institute Interaction Meet was organized with Industry experts and subject experts on 26-12-2016 and the suggestions from Industrialists have also been incorporated in the curriculum. The new Curricula for the different diploma courses have been designed with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, besides reviewed by Expert Committee constituted with eminent academicians.

The primary objective of the curricular change is to produce best technicians in the country by correlating growing needs of the industries with the academic input.

The revised New Curriculum i.e., Curriculum–2016 (C-16) is approved by BoG of SBTET for its implementation with effect from 2016-17.

Salient Features:

1. Duration of course is either 3 years / 3½ years duration of Regular Academic Instruction.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months/ 1 year Industrial Training is introduced for all the Diploma courses.
4. Fundamentals of Internet of Things (IOT) is introduced for all the Diploma courses in the subject.

5. Modern subjects relevant to the industry are introduced in all the Diploma courses.
6. CISCO course content has been incorporated into the ECE and CME courses to get certification from CISCO along with Diploma.
7. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.
8. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the Industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are introduced for all the branches.
9. Modern topics relevant to the needs of the industry and global scenario suitable to be taught at Diploma level are also incorporated in the curriculum.
10. AutoCAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
11. Every student is exposed to the computer lab at the 1st year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.
12. Upon reviewing the existing C-14 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In the revised C-16 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.
13. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.
14. Curricula of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available at the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to conform to the field requirements of industry.
15. The Members of the working group are grateful to Sri G.S. Panda Das, I.A.S., Special Commissioner of Technical Education & Chairman of SBTET, AP. and Sri. Adityanath Das, I.A.S., Principal Secretary of Higher Education for their guidance and valuable inputs in revising, modifying and updating the curriculum.
16. The Members acknowledge with thanks the cooperation and guidance provided by Sri. A.Nirmal Kumar Priya, Secretary, SBTET, Andhra Pradesh and other officials of Directorate of Technical Education and the State Board of Technical Education, Andhra Pradesh, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

RULES AND REGULATIONS

1 DURATION AND PATTERN OF THE COURSES

All the Diploma programs run at various institutions are of AICTE approved 3 years or 3½ years duration of academic instruction.

All the Diploma courses are run on year wise pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in BM course, the training will be in the seventh semester. Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.

2 PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:

Selection of candidates is governed by the Rules and regulations laid down in this regard from time to time.

- a) Candidates who wish to seek admission in any of the Diploma courses will have to appear for Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Andhra Pradesh, Vijayawada.

Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).

- b) The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of making application to the Common Entrance Test for admissions into Polytechnics (POLYCET). In case of candidates whose results of their Qualifying Examinations is pending, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of admission
- c) Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Andhra Pradesh from time to time.
- d) For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.
1). D.H.M.C.T. 2).D. Pharmacy

3 MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4 PERMANENT IDENTIFICATION NUMBER (PIN)

A cumulative / academic record is to be maintained of the Marks secured in sessional work and end examination of each year for determining the eligibility for promotion etc., A Permanent Identification Number (PIN) will be allotted to each admitted candidate to maintain academic records.

5 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

- a). The Academic year for all the Courses shall be in accordance with the Academic Calendar.
- b). The Working days in a week shall be from Monday to Saturday
- c). There shall be 7 periods of 50 minutes duration on all working days.
- d). The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to cover the syllabus.

6 ELIGIBILITY OF ATTENDANCE TO APPEAR FOR THE END EXAMINATION

- a). A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.
- b). Condonation of shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester or 1st year may be granted on medical grounds.
- c). A stipulated fee shall be payable towards condonation for shortage of attendance.
- d). Candidates having less than 65% attendance shall be detained.
- e). Students whose shortage of attendance is not condoned in any semester / 1st year and not paid the condonation fee in time are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1st year when offered next.

7 READMISSION

Readmission shall be granted to eligible candidates by the respective Principal/ Regional Joint Director.

1. a) Within 15 days after commencement of class work in any semester (Except Industrial Training).
- b) For Industrial Training: before commencement of the Industrial training.
2. Within 30 days after commencement of class works in any year (including D. Pharmacy course or first year course in Engineering and Non Engineering Diploma streams).

Otherwise such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.

The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work, after readmission is granted.

8 SCHEME OF EXAMINATION

a) First Year

THEORY EXAMINATION: Each Subject carries 80% marks with examination of 3 hours duration, along with 20% marks for internal evaluation. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

PRACTICAL EXAMINATION: There shall be 40% Marks for regular practical work done, i.e. sessional marks for each practical subject with an end examination of 3 hours duration carrying 60% marks. However, there are no minimum marks prescribed for sessionals.

b) III, IV, V, VI and VII Semesters:

THEORY EXAMINATION: Each subject carries usually 80 marks and 30 marks in respect of specified subjects of 3hours duration, along with 20 marks for internal evaluation (sessional marks) respectively.

PRACTICAL EXAMINATION: Each subject carry 60/30 marks of 3hours duration 40/20 sessional marks.

9 INTERNAL ASSESSMENT SCHEME

- a) Theory Subjects: Theory Subjects carry 20% sessional marks, Internal examinations will be conducted for awarding sessional marks on the dates specified. **Three unit tests will be conducted for I year students and two Unit Tests for semesters.** Average of marks obtained in all the prescribed tests will be considered for awarding the sessional marks.
- b) Practical Subjects: Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40% marks in each practical subject. Allotment of marks should be discrete taking into consideration of the students' skills, accuracy, recording and performance of the task assigned to him / her. Each student has to write a record / log book for assessment purpose. In the subject of Drawing, which is also considered as a practical paper, the same rules hold good. Drawing exercises are to be filed in seriatum.
- c) Internal assessment in Labs / workshops / Survey field work etc., during the course of study shall be done and sessional marks shall be awarded by the

concerned Lecturer / Senior Lecturer / Workshop superintendent as the case may be.

- d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from any local Industry/ nearby Government Polytechnic/ Local Government Organization. Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.
- e) Question Paper for Practicals: Question paper should cover all the experiments / exercise prescribed.
- f) Records pertaining to internal assessment marks of both theory and practical subjects are to be maintained for official inspection.
- g) **In case of Diploma courses *having Industrial Training***, the training assessment shall be done and the marks are to be awarded in the following manner.

Industrial assessment	:	200 marks (in two spells of 100 marks each)
Maintenance of log book	:	30 marks
Record Work	:	30 marks
Seminar / viva-voce	:	40 marks

TOTAL	:	300 marks

The assessment at the institution level (Seminar/Viva-voce) shall be done by three members, viz., Internal Faculty member, External Examiner and Head of Section and be averaged.

10 MINIMUM PASS MARKS

THEORY EXAMINATION:

For passing a theory subject, a candidate has to secure a minimum of 35% in end examination and a combined minimum of 35% of both Sessional and end examination marks put together.

PRACTICAL EXAMINATION:

For passing a practical subject, a candidate has to secure a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and

short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand subjects of D.C.C.P course.

11. PROVISION FOR IMPROVEMENT

1. Improvement is allowed only after he / she has completed all the subjects from First Year to Final semester of the Diploma.
2. Improvement is allowed in any 4 (Four) subjects of the Diploma.
3. The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.
4. No improvement is allowed in Practical / Lab subjects or Project work or Industrial Training assessment. However, improvement in drawing subject(s) is allowed.
5. If improvement is not achieved, the marks obtained in previous Examinations hold good.
6. Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
7. Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
8. All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

12. RULES OF PROMOTION FROM 1ST YEAR TO 3rd, 4th, 5th, 6th and 7th SEMESTERS:

a) For Diploma Courses of 3 Years duration

- i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.
- ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

- iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she

- i) Puts the required percentage of attendance in the 4th semester
- ii) Should not have failed in more than Four backlog subjects of 1st year

For IVC & ITI Lateral Entry Students:

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester

- iv) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester examination if he/she

- i) Puts the required percentage of attendance in the 5th semester
- ii) Should get eligibility to appear for 4th Semester examination.

For IVC& ITI Lateral Entry students:

- i) Puts the required percentage of attendance in the 5th semester
- ii) Should not have failed in more than Four backlog subjects of 3rd Semester

- v) A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pay the examination fee. A candidate who could not pay the 5th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6th semester.

A candidate is eligible to appear for 6th semester Industrial Training assessment (Seminar/Viva-voce)

- i) Puts the required percentage of attendance, ie., 90% in 6th semester Industrial

Training

- ii) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance, ie., 90% in 6th semester Industrial Training.
- ii) should get eligibility to appear for 5th Semester Examination.

Important Note:

Seminar/Viva-voce should not be conducted for Not-Eligible Candidates, till the candidate gets eligibility. The record of internal assessment for Industrial Training for 260 marks shall be maintained at Institution Level for all candidates and the data is to be uploaded only for eligible candidates. For not eligible candidates the data is to be uploaded as and when the candidate gets eligibility.

b) For Diploma Courses of 3 ½ Years duration (MET/ CH/ CHPP/ CHPC/ CHOT/ TT):

1. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.
2. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the 1st year and pays the examination fee. A candidate who could not pay the 1st year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.
3. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester exam if he/she

- i) Puts the required percentage of attendance in the 4th semester
- ii) Should not have failed in more than Four backlog subjects of 1st year.

For IVC & ITI Lateral Entry students:

- (i) Puts the required percentage of attendance in the 4th semester
4. A candidate shall be promoted to 5th semester industrial training provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

5. Promotion from 5th to 6th semester is automatic (i.e., from 1st spell of Industrial Training to 2nd spell) provided he/she puts the required percentage of attendance, which in this case i.e., 90 % of attendance and attends for the VIVA-VOCE examination at the end of training.
6. A candidate shall be promoted to 7th semester provided he / she puts the required percentage of attendance in the 6th semester and pays the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 7th semester.
7. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training.

A candidate is eligible to appear for 7th semester examination if he/she

- i) Puts the required percentage of attendance in the 7th semester
- ii) Should get eligibility to appear for 4th semester Examination.

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance in the 7th semester
- ii) Should not have failed more than four backlog subjects of 3rd Semester

OTHER DETAILS

- a) In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.
- b) The I spell of Industrial training shall commence 10 days after the completion of the last theory examination of 4th Semester.
- c) The Second spell of Industrial training shall commence within 10 days after the completion of I spell of Industrial training.

c) For Diploma Courses of 3 ½ Years duration (BM):

The same rules which are applicable for conventional courses also apply for this course. The industrial training in respect of this course is restricted to one semester (6 months) after the 6th semester (3 years) of the course.

1. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

2. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.
3. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate who could not pay the 3rd semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she

- i) Puts the required percentage of attendance in the 4th semester
- ii) Should not have failed in more than Four backlog subjects of 1st year

For IVC & ITI Lateral Entry Students:

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester

4. A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester exam if he/she

- i) Puts the required percentage of attendance in the 5th semester
- ii) Should get eligibility to appear for 4th Semester examination.

For IVC & ITI Lateral Entry students:

- iii) Puts the required percentage of attendance in the 5th semester
- iv) Should not have failed in more than Four backlog subjects of 3rd Semester

5. A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pays the examination fee.

A candidate who could not pay the 5th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6th semester.

A candidate is eligible to appear for 6th semester examination

- i) Puts the required percentage of attendance in 6th semester and
- ii) should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance in 6th semester.
 - ii) should get eligibility to appear for 5th Semester Examination.
6. A candidate shall be promoted to 7th semester provided he/she puts the required percentage of attendance in 6th semester and pay the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee prescribed by SBTET from time to time before commencement of the 7th semester (Industrial Training).

A candidate is eligible to appear for 7th semester Industrial Training assessment (Seminar/Viva-voce) if he/she

- i) Puts the required percentage of attendance, ie., 90% in 7th semester Industrial Training
- ii) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance, ie., 90% in 7th semester Industrial Training.
- ii) Should get eligibility to appear for 5th Semester Examination.

Important Note:

Seminar/Viva-voce should not be conducted for Not-Eligible Candidates, till the candidate gets eligibility. However, the record of internal Assessment for Industrial Training for 260 marks shall be maintained at Institution Level for all candidates and the data is to be uploaded only for eligible candidates. For not eligible candidates the data is to be uploaded as and when the candidate gets eligibility.

OTHER DETAILS

- a) In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.
- b) The Industrial training shall commence 10 days after the completion of the last theory examination of 6th Semester.

13. STUDENTS PERFORMANCE EVALUATION

Successful candidates shall be awarded the Diploma under the following divisions of pass.

1. First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
2. First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
3. Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.

The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.

In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3rd semester (i.e., second year) level the aggregate of (100%) marks secured at the 3rd and subsequent semesters of study shall be taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.

4. Second Class shall be awarded to all students, who fail to complete the Diploma in the regular 3 years/ 3 ½ years and four subsequent examinations, from the year of first admission.

14. EXAMINATION FEE SCHEDULE:

The examination fee should be as per the notification issued by State Board of Technical Education and Training from time to time.

15. STRUCTURE OF END EXAMINATION QUESTION PAPER:

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular subject be considered Examination paper is of 3/6/9 hours duration.

- a) Each theory paper consists of Section 'A' and Section 'B'. Section 'A' contains 10 short answer questions. All questions are to be answered and each carries 3 marks Max. Marks: 10 x 3 = 30.
Section B contains 8 essay type questions including Numerical questions, out of which 5 questions each carrying 10 marks are to be answered.

Max.Marks: 5 x 10 = 50.

Total Maximum Marks: 80.

b) For Engineering Drawing Subject (107) consist of section 'A' and section 'B'. Section 'A' contains four (4) questions. All questions in section 'A' are to be answered and each carries 5 marks. Max. Marks: $4 \times 5=20$. Section 'B' contains six (6) questions. Out of which four (4) questions to be answered and each question carries 10 Marks. Max. Marks $4 \times 10 = 40$.

c) Practical Examinations

For Workshop practice and Laboratory Examinations, Each student has to pick up a question paper distributed by Lottery System.

Max. Marks for an experiment / exercise : 50%

Max. Marks for VIVA-VOCE : 10%

Total : 60% (of total marks for the subject)

In case of practical examinations with 50 marks, the marks will be worked out basing on the above ratio.

In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

16. ISSUE OF MEMORANDUM OF MARKS

All candidates who appear for the end examination will be issued memorandum of marks without any payment of fee. However candidates who lose the original memorandum of marks have to pay the prescribed fee to the Secretary, State Board of Technical Education and Training, A.P. for each duplicate memo.

17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA COURSES:

Maximum period for completion of the diploma courses is twice the duration of the course from the date of First admission (includes the period of detention and discontinuation of studies by student etc) failing which they will have to forfeit the claim for qualifying for the award of Diploma (They will not be permitted to appear for examinations after that date). This rule applies for all Diploma courses of 3 years and 3 ½ years of engineering and non-engineering courses.

18. ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfils the following academic regulations.

- i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.
- ii. He / she has completed all the subjects.

Students who fail to fulfill all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

For IVC & ITI Lateral Entry students:

- i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.
- ii. He / she has completed all the subjects.

Students who fail to fulfill all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

19. ISSUE OF PHOTO COPY OF VALUED ANSWER SCRIPT, RECOUNTING & REVERIFICATION:

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

1. A candidate desirous of applying for Photo copy of valued answer script/ scripts should apply within prescribed date from the date of the declaration of the result.
2. Photo copies of valued answer scripts will be issued to all theory subjects and Drawing subject(s).
3. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
4. No application can be entertained from third parties.

B) FOR RE-COUNTING(RC) and RE-VERIFICATION(RV) OF THE VALUED ANSWER SCRIPT

1. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.
2. Re-verification of valued answer script shall be done for all theory subjects and Drawing subject(s).
3. The Re-verification committee constituted by the Secretary, SBTETAP with subject experts shall re-verify the answer scripts.

I) RE-COUNTING

The Officer of SBTET will verify the marks posted and recount them in the already valued answer script. The variations if any will be recorded separately, without

making any changes on the already valued answer script. The marks awarded in the original answer script are maintained (hidden).

2) RE-VERIFICATION

- (i) The Committee has to verify the intactness and genuineness of the answer script(s) placed for Re-verification.
 - (ii) Initially single member shall carry out the re-verification.
 - (iii) On re-verification by single member, if the variation is less than 12% of maximum marks, and if there is no change in the STATUS in the result of the candidate, such cases will not be referred to the next level i.e., for 2-Tier evaluation.
 - (iv) On re-verification by a single member, if the variation is more than 12% of maximum marks, it will be referred to 2-Tier evaluation.
 - (v) If the 2-Tier evaluation confirms variation in marks as more than 12% of maximum marks, the variation is considered as follows:
 - a) If the candidate has already passed and obtains more than 12% of the maximum marks on Re-verification, then the variation is considered.
 - b) If the candidate is failed and obtains more than 12% of the maximum marks on Re-verification and secured pass marks on re-verification, then the status of the candidate changes to PASS.
 - c) If a candidate is failed and obtains more than 12% of the maximum marks on Re-verification and if the marks secured on re-verification are still less than the minimum pass marks, the status of the candidate remain FAIL only.
 - (vii) After Re-verification of valued answer script the same or change if any therein on Re-verification, will be communicated to the candidate.
 - (viii) On Re-verification of Valued Answer Script if the candidate's marks are revised, the fee paid by the candidate will be refunded or else the candidate has to forfeit the fee amount.
4. No request for Photo copies/ Recounting /Re-verification of valued answer script would be entertained from a candidate who is reported to have resorted to Malpractice in that examination.

20. MAL PRACTICE CASES:

If any candidate resorts to Mal Practice during examinations, he / she shall be booked and the Punishment shall be awarded as per SBTETAP rules and regulations in vogue.

21. DISCREPANCIES/ PLEAS:

Any Discrepancy /Pleas regarding results etc., shall be represented to the SBTETAP within one month from the date of issue of results. Thereafter, no such cases shall be entertained in any manner.

22. ISSUE OF DUPLICATE DIPLOMA

If a candidate loses his/her original Diploma Certificate and desires a duplicate to be issued he/she should produce written evidence to this effect. He / she may obtain a duplicate from the Secretary, State Board of Technical Education and Training, A.P., on payment of prescribed fee and on production of an affidavit signed before a First Class Magistrate (Judicial) and *non-traceable certificate* from the Department of Police. In case of damage of original Diploma Certificate, he / she may obtain a duplicate certificate by surrendering the original damaged certificate on payment of prescribed fee to the State Board of Technical Education and Training, A.P.

In case the candidate cannot collect the original Diploma within 1 year from the date of issue of the certificate, the candidate has to pay the penalty prescribed by the SBTET from time to time.

23. ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

The Board on payment of prescribed fee will issue these certificates for the candidates who intend to prosecute Higher Studies in India or Abroad.

24. GENERAL

- i. The Board may change or amend the academic rules and regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.
- ii. All legal matters pertaining to the State Board of Technical Education and Training are within the jurisdiction of Vijayawada.
- iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P is final.

**3 & ½ YEARS DIPLOMA IN
BIOMEDICAL ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION
FIRST YEAR**

Sub Code	Name of the Subject	Instructional hours		Total Periods / Year	Scheme of Examination			
		T	P		Durati on (HRS)	Sessional Marks	End Exam Marks	Total Marks
BM-101	English	3	--	90	3	20	80	100
BM-102	Engineering Mathematics –I	5	--	150	3	20	80	100
BM-103	Engineering Physics	4	--	120	3	20	80	100
BM-104	Engineering chemistry & Environmental studies	4		120	3	20	80	100
BM-105	Basic Electrical Engineering	4	--	120	3	20	80	100
BM-106	Electronic Components & Devices	4	--	120	3	20	80	100
PRACTICAL SUBJECTS								
BM-107	Engineering Drawing	--	6	180	3	40	60	100
BM-108	Electronic Components & Devices Laboratory	--	6	180	3	40	60	100
BM-109	Physics Laboratory	--	3	90	3	20	30	50
BM-110	Chemistry Laboratory				3	20	30	50
BM-111	Computer Fundamental Laboratory	-	3	90	3	40	60	100
	TOTAL	24	18	1260	-	290	710	1000

**3 & ½ YEARS DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
THIRD SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination			
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks
BM-301	Engineering Mathematics- II	6	--	90	3	20	80	100
BM-302	Electronic Circuits	6	--	90	3	20	80	100
BM-303	Network Analysis	6	--	90	3	20	80	100
BM-304	Digital Electronics	6	--	90	3	20	80	100
BM-305	Programming In 'C'	6	--	90	3	20	80	100
BM-306	Communication Skills Lab Practice	--	3	45	3	40	60	100
BM-307	Electronic Circuits & Network Analysis Lab Practice	--	3	45	3	40	60	100
BM-308	Digital Electronics Lab Practice	--	3	45	3	40	60	100
BM-309	Programming In 'C' & MATLAB Practice	--	3	45	3	40	60	100
		30	12	630		260	640	900

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
FOURTH SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination				
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks	
BM-401	Linear Integrated Circuits Applications	6	--	90	3	20	80	100	
BM-402	Communication & Data Transmission	6	--	90	3	20	80	100	
BM-403	Microprocessors & interfacing	6	--	90	3	20	80	100	
BM-404	Physiological Systems Engineering	6	--	90	3	20	80	100	
BM-405	Bio-Medical Instrumentation	6	--	90	3	20	80	100	
BM-406	LIC & ECAD Lab Practice	--	3	45	3	40	60	100	
BM-407	Communication & Data Transmission Lab Practice	--	3	45	3	40	60	100	
BM-408	Microprocessors & interfacing Lab	--	3	45	3	40	60	100	
BM-409	Biomedical Instrumentation lab	--	3	45	3	40	60	100	
		30	12	630		260	640	900	

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION
FIFTH SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination				
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks	
BM-501	Computer Networks	5	--	75	3	20	80	100	
BM-502	Measurement & Test Equipment	5	--	75	3	20	80	100	
BM-503	Bio-Medical Equipment	5	--	75	3	20	80	100	
BM-504	Analytical Instrumentation Engineering	5	--	75	3	20	80	100	
BM-505	Medical Implants Engineering	5	--	75	3	20	80	100	
BM-506	Medical Informatics & Telemedicine	5	--	75	3	20	80	100	
BM-507	Measurement & Test Equipment Lab Practice	--	3	45	3	40	60	100	
BM-508	Life Skills	--	3	45	3	40	60	100	
BM-509	Computer Hardware & Networking Lab Practice	--	3	45	3	40	60	100	
BM-510	Analytical Instrumentation Lab Practice	--	3	45	3	40	60	100	
		30	12	630	27	280	720	1000	

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
SIXTH SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination				
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks	
BM-601	Hospital Management & Entrepreneurship	6	--	90	3	20	80	100	
BM-602	Microcontroller & Embedded Systems	6	--	90	3	20	80	100	
BM-603	Advanced Biomedical Equipment	6	--	90	3	20	80	100	
BM-604	Medical Imaging Techniques	6	--	90	3	20	80	100	
BM-605	Biomedical Signal Processing	6	--	90	3	20	80	100	
BM-606	Microcontroller & Embedded Systems Lab Practice	--	3	45	3	40	60	100	
BM-607	Biomedical Equipment Lab Practice	--	3	45	3	40	60	100	
BM-608	Biomedical Signal Processing Lab Practice	--	3	45	3	40	60	100	
BM-609	Biomedical circuits Design & Servicing Lab	--	3	45	3	40	60	100	
		30	12	630	27	260	640	900	

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
VII SEMESTER (6 MONTHS)
(IN PLANT TRAINING)**

S. No	Subjects	Duration	Scheme of Examination		No. of Credits	Remarks
			Nature of Evaluation	Max. Marks		
1	BM-701	Six months	VIVA VOCE		16	At the industry
			Training	200		
	BM-702		Project report Seminar/ Viva - Voce	100	8	At the institution
			TOTAL	300	24	

FIRST YEAR

**3 & ½ YEARS DIPLOMA IN
BIOMEDICAL ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION
FIRST YEAR**

Sub Code	Name of the Subject	Instructional hours		Total Periods / Year	Scheme of Examination			
		T	P		Durati on (HRS)	Sessional Marks	End Exam Marks	Total Marks
BM-101	English	3	--	90	3	30	70	100
BM-102	Engineering Mathematics –I	5	--	150	3	20	80	100
BM-103	Engineering Physics	4	--	120	3	20	80	100
BM-104	Engineering chemistry & Environmental studies	4		120	3	20	80	100
BM-105	Basic Electrical Engineering	4	--	120	3	20	80	100
BM-106	Electronic Components & Devices	4	--	120	3	20	80	100
PRACTICAL SUBJECTS								
BM-107	Engineering Drawing	--	6	180	3	40	60	100
BM-108	Electronic Components & Devices Lab	--	6	180	3	40	60	100
BM-109	Physics Lab Practice	--	3	90	3	20	30	50
BM-110	Chemistry Lab Practice				3	20	30	50
BM-111	Computer Fundamental Lab Practice	-	3	90	3	40	60	100
	TOTAL	24	18	1260	-	290	710	1000

C-16-COMMON-101- ENGLISH
(Common to all Branches)

Subject Title : ENGLISH
Subject Code : Common - 101
Periods per Week : 03
Periods per Year : 90

Time Schedule& Weightage

Sl No	Major Topics	Titles of the Lessons	No. of Periods	Weightage of Marks	No of Short Answers	No of Long Answers
1	Vocabulary& Need for English	Lessons 1,2& Regular and essential vocabulary	5	13	1	1
2	Grammar	Lessons 11,12 & 19 to 26	30	31	7	1
3	Reading	Lessons 13 To 18	10	10	-	1
4	Writing	Lessons 27 To 40	30	40	-	4
5	English in Action	Lessons 3 To 10	15	16	2	1
		Total	90	110	10	08

Rationale and Scope

Globalization has ushered in an era of opportunities for those who have the necessary competencies. Effective communication is one among them. This shift demands strengthening of English in polytechnics. In C-16 Curriculum the focus is on the special needs of English for technicians.

. This course aims at integration of the four fold language abilities viz., listening, speaking, reading and writing. The use of English for learning technical subjects and for performing technical functions like, writing reports, giving instructions and interpreting graphics/data is of great importance. Therefore the curriculum C-16 focuses on improving communicative abilities equipping the students to become industry- ready and employable.

On completion of this course the student will be able to:

- 1.0 Build vocabulary in the direction of future needs
- 2.0 Learn various grammatical structures
- 3.0 Read and comprehend English and understand the details and draw inferences
- 4.0 Learn to be competent in various forms of written communication (writing composition and data interpretation)
- 5.0 Practice spoken communication suited to various situations.

1.0 Extend their vocabulary in the direction of their future needs

- 1.1 Locate words, learn spellings, understand meanings
- 1.2 Pronounce words intelligibly
- 1.3 Find synonyms and antonyms
- 1.4 Use affixation
- 1.5 Comprehend meanings of words by understanding meanings of roots

2.0 Learn various grammatical structures

- 2.1 Identify and use nouns
- 2.2 Identify and use pronouns
- 2.3 Use the present tense
- 2.4 Use the past tense
- 2.5 Use the future tense
- 2.6 Identify and use adjectives
- 2.7 Identify and use adverbs
- 2.8 Use prepositions
- 2.9 Use linkers
- 2.10 State basic sentence structures
- 2.11 Construct different types of sentences
- 2.12 Frame questions to elicit information
- 2.13 Frame questions for confirmation
- 2.14 Use active voice
- 2.15 Use passive voice
- 2.16 Use direct speech
- 2.17 Use indirect speech
- 2.18 Identify and correct errors

3.0 Read and comprehend English

- 3.1 Identify the main ideas
- 3.2 Identify the specific details

- 3.3 Draw inferences
- 3.4 Give contextual meanings of the words
- 3.5 Perceive tone in a text

4.0 Learn to excel in various forms of written communication (writing composition and data interpretation)

- 4.1 Identify components of a good paragraph
- 4.2 Write types of paragraphs
- 4.3 Distinguish between formal and informal letters
- 4.4 Write personal letters
- 4.5 Write leave letters
- 4.6 Write official letters
- 4.7 Write letters of complaints
- 4.8 Prepare a resume
- 4.9 Write a cover letter
- 4.10 Write short messages
- 4.11 Report incidents
- 4.12 Report experiments
- 4.13 Report Industrial visits
- 4.14 Write work done statements
- 4.15 Write maintenance reports
- 4.16 Make notes using Cue method and Mapping method
- 4.17 Summarize Paragraphs
- 4.18 Present and Interpret Data from flow charts, tree diagrams, bar graphs, tables, pie charts

Practice spoken communication suited to various situations.

- 4.19 Use appropriate expressions to greet and take leave
- 4.20 Use proper expressions to make requests
- 4.21 Use apt expressions for asking and giving directions
- 4.22 Use suitable expressions to seek and offer suggestions
- 4.23 Use suitable expressions to state intentions
- 4.24 Use suitable expressions to state feelings
- 4.25 Use appropriate expressions to state agreement and disagreement
- 4.26 Use proper expressions to make complaints
- 4.27 Use suitable expressions to express obligations

Course Material

The textbook prepared by the faculty of English of Polytechnics in AP.

Reference Books

- | | |
|---|--------------------------|
| 1. Essential English Grammar (Intermediate Level) | Raymond Murphy |
| 2. Learn English (A Fun Book of Functional Language, Grammar and Vocabulary) | Santanu Sinha Chaudhuri |
| 3. Grammar Builder (Entire Series) | Oxford University Press |
| 4. High School English Grammar (Revised Edition) | Wren and Martin |
| 5. Sentence skills with Readings (fourth Edition, Tata McGraw Hill) | John Langan, Paul Langan |
| 6. Word Power Made Easy | Norman Lewis |
| 7. Spoken English | Shashi Kumar and Dhamija |

Engineering Mathematics - I

(Common to all Branches)

Subject Title : **Engineering Mathematics - I**

Subject Code : **Common- 102**

Periods per Week : **5**

Periods per Year : **150**

Time Schedule

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
		Theory	Practice		R	U	App	R	U	App
	Unit - I : Algebra									
1	Logarithms	3	0	0	0	0	0	0	0	0
2	Partial Fractions	5	0	3	0	1	0	0	0	0
3	Matrices and Determinants	10	10	16	2	0	0	0	0	1
	Unit - II : Trigonometry									
4	Trigonometric Ratios	2	0	0	0	0	0	0	0	0
5	Compound Angles	3	2	3	1	0	0	0	0	0
6	Multiple and Submultiple angles	4	4	3	0	1	0	0	0	0
7	Transformations	4	4	5	0	0	0	1/2	0	0
8	Inverse Trigonometric Functions	3	2	5	0	0	0	0	1/2	0
9	Trigonometric Equations	3	2	5	0	0	0	1/2	0	0
10	Properties and solutions of triangles	4	4	5	0	0	0	0	0	1/2
11	Hyperbolic Functions	2	0	0	0	0	0	0	0	0
12	Complex Numbers	4	2	3	1	0	0	0	0	0
	Unit III : Co-ordinate Geometry									

13	Straight Lines	5	3	6	1	1	0	0	0	0
14	Circle	4	2	5	0	0	0	0	1/2	0
15	Conic Sections	4	3	5	0	0	0	0	1/2	0
	Unit – IV : Differential Calculus									
16	Limits and Continuity	4	2	3	0	1	0	0	0	0
17	Differentiation	18	10	23	1	0	0	1	1	0
S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	Unit - V : Applications of Differentiation	Theory	Practice		R	U	App	R	U	App
18	Geometrical Applications	3	2	5	0	0	0	0	0	1/2
19	Physical Applications	2	2	5	0	0	0	0	0	1/2
20	Maxima and Minima	3	4	5	0	0	0	0	0	1/2
21	Errors and Approximations	2	0	5	0	0	0	0	0	1/2
Total		92	58	110	6	4	0	2	2 1/2	3 1/2
				Marks	18	12	0	20	25	35

R: Remembering type 38 marks
U: Understanding type 37 marks
App: Application type 35 marks

ENGINEERING MATHEMATICS – I
COMMON TO ALL BRANCHES – 102

Objectives

Upon completion of the course the student shall be able to:

UNIT – I

Algebra

1.0 Use Logarithms in engineering calculations

- 1.1 Define logarithm and list its properties.
- 1.2 Distinguish natural logarithms and common logarithms.
- 1.3 Explain the meaning of e and exponential function.
- 1.4 State logarithm as a function and its graphical representation.
- 1.5 Use the logarithms in engineering calculations.

2.0 Resolve Rational Fraction into sum of Partial Fractions in engineering problems

2.1 Define the following fractions of polynomials:

1. Rational,
2. Proper and
3. Improper

2.2 Explain the procedure of resolving rational fractions of the type mentioned below into partial fractions

$$\begin{array}{ll} i) \quad \frac{f(x)}{(x+a)(x+b)(x+c)} & ii) \quad \frac{f(x)}{(x+a)^2(x+b)(x+c)} \\ iii) \quad \frac{f(x)}{(x^2+a)(x+b)} & iv) \quad \frac{f(x)}{(x+a)(x^2+b)^2} \end{array}$$

3.0 Use Matrices for solving engineering problems

- 3.1 Define a matrix and order of a matrix.
- 3.2 State various types of matrices with examples (upto 3rd order square matrices).
- 3.3 Compute sum, scalar multiplication and product of matrices.
- 3.4 Illustrate the properties of these operations such as associative, distributive, commutative properties with examples and counter examples.

- 3.5 Define the transpose of a matrix and write its properties.
- 3.6 Define symmetric and skew-symmetric matrices.
- 3.7 Resolve a square matrix into a sum of symmetric and skew- symmetric matrices with examples in all cases.
- 3.8 Define minor, co-factor of an element of 2X2 and 3x3 square matrices with examples.
- 3.9 Expand the determinant of a 3 x 3 matrix using Laplace expansion formula.
- 3.10 Distinguish singular and non-singular matrices.
- 3.11 State properties of determinants with simple examples.
- 3.12 Define multiplicative inverse of a matrix and list properties of adjoint and inverse.
- 3.13 Compute adjoint and multiplicative inverse of a square matrix.
- 3.14 Representation of system of linear equations (2 variables in 2 equations and 3 variables in 3 equations) in matrix form.
- 3.15 Solve system of linear equations using Cramer's rule.
- 3.16 Solve system of linear equations by matrix inversion method
- 3.17 State elementary row operations.
- 3.18 Solve a system of linear equations by Gauss- Jordan method

UNIT – II

Trigonometry :

4.0 Understand Trigonometric Ratios

- 4.1 Define trigonometric ratios of any angle.
- 4.2 List the values of trigonometric ratios at specified values.
- 4.3 Draw graphs of trigonometric functions
- 4.4 Explain periodicity of trigonometric functions.

5.0 Solve simple problems on Compound Angles

- 5.1 Define compound angles and state the formulae of $\sin(A\pm B)$, $\cos(A\pm B)$, $\tan(A\pm B)$ and $\cot(A\pm B)$
- 5.2 Give simple examples on compound angles to derive the values of $\sin 15^\circ$, $\cos 15^\circ$, $\sin 75^\circ$, $\cos 75^\circ$, $\tan 15^\circ$, $\tan 75^\circ$ etc.
- 5.3 Derive identities like $\sin (A+B) \sin(A-B) = \sin^2 A - \sin^2 B$ etc.,
- 5.4 Solve simple problems on compound angles.

6.0 Solve problems using the formulae for Multiple and Sub- multiple Angles

- 6.1 Derive the formulae of multiple angles $2A$, $3A$ etc and sub multiple angles $A/2$ in terms of angle A of trigonometric functions.
- 6.2 Derive useful allied formulas like $\sin A = (1 - \cos 2A)/2$ etc.,
- 6.3 Solve simple problems using the above formulae

7.0 Apply Transformations for solving the problems in Trigonometry

- 7.1 Derive the formulae on transforming sum or difference of two trigonometric ratios in to a product and vice versa- examples on these formulae.

8.0 Use Inverse Trigonometric Functions for solving engineering problems

- 8.1 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.
- 8.2 Define inverses of six trigonometric functions along with their domains and ranges.
- 8.3 Derive relations between inverse trigonometric functions so that given $A = \sin^{-1}x$, express angle A in terms of other inverse trigonometric functions - with examples.
- 8.4 State various properties of inverse trigonometric functions and identities like $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$ etc.
- 8.5 Derive formulae like $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$, where $x \geq 0, y \geq 0, xy < 1$ etc., and solve simple problems.

9.0 Solve Trigonometric Equations in engineering applications

- 9.1 Explain what is meant by solutions of trigonometric equations and find the general solutions of $\sin x = k$, $\cos x = k$ and $\tan x = k$ with appropriate examples.
- 9.2 Solve models of the type $a \sin^2 x + b \sin x + c = 0$, $a \cos x + b \sin x = c$ etc., and problems using simple transformations.

10.0 Appreciate Properties of triangles and their solutions

- 10.1 State sine rule, cosine rule, tangent rule and projection rule.
- 10.2 Explain the formulae for $\sin A/2$, $\cos A/2$, $\tan A/2$ and $\cot A/2$ in terms of semi-perimeter and sides a, b, c .
- 10.3 List various formulae for the area of a triangle.
- 10.4 Solve problems using the above formulae.

10.5 Solve a triangle when (i) three sides, (ii) two sides and an included angle, (iii) two sides and an opposite angle-case of two solutions and (iv) one side and two angles are given.

11.0 Represent the Hyperbolic Functions in terms of logarithm functions

11.1 Define Sinh x , cosh x and tanh x and list the hyperbolic identities.

11.2 Represent inverse hyperbolic functions in terms of logarithms.

12.0 Represent Complex numbers in various forms

12.1 Define complex number, its modulus, conjugate and list their properties.

12.2 Define the operations on complex numbers with examples.

12.3 Define amplitude of a complex number

12.4 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form – illustrate with examples.

12.5 State DeMoivre's theorem and its applications to complex numbers e.g., finding the roots, powers, simplifications of a complex number with illustrative examples

UNIT - III

Coordinate Geometry

13.0 Solve the problems on Straight lines

13.1 Write the different forms of a straight line – point slope form, two point form, intercept form, normal form and general form

13.2 Solve simple problems on the above forms

13.3 Find distance of a point from a line, acute angle between two lines, intersection of two non-parallel lines and distance between two parallel lines.

14.0 Solve the problems on Circles

14.1 Define locus of a point – circle and its equation.

14.2 Find the equation of a circle given

(i) Center and radius

(ii) Two ends of a diameter

(iii) Centre and a point on the circumference

(iv) Three non collinear points

14.3 Write the general equation of a circle and find the centre and radius.

15.0 Appreciate the properties of Conics in engineering applications

- 15.1 Define a conic section.
- 15.2 Explain the terms focus, directrix, eccentricity, axes and latus rectum of a conic with illustrations.
- 15.3 Find the equation of a conic when focus, directrix and eccentricity are given
- 15.4 Describe the properties of Parabola, Ellipse and Hyperbola in standard form.

UNIT - IV

Differential Calculus

16.0 Use the concepts of Limit and Continuity for solving the problems

- 16.1 Explain the concept of limit and meaning of $\lim_{x \rightarrow a} f(x) = l$ and state the properties of limits.

- 16.2 Mention the Standard limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$, $\lim_{x \rightarrow 0} \frac{\sin x}{x}$, $\lim_{x \rightarrow 0} \frac{\tan x}{x}$, $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$,

$$\lim_{x \rightarrow 0} \frac{e^x - 1}{x}, \quad \lim_{x \rightarrow 0} (1 + x)^{\frac{1}{x}}, \quad \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x \quad (\text{All without proof}).$$

- 16.3 Solve the problems using the above standard limits
- 16.4 Evaluate the limits of the type $\lim_{x \rightarrow l} \frac{a x^2 + b x + c}{\alpha x^2 + \beta x + \gamma}$ and $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$
- 16.5 Explain the concept of continuity of a function at a point and on an interval with some examples whether a given function is continuous or not.

17.0 Appreciate Differentiation and its meaning in engineering situations

- 17.1 State the concept of derivative of a function $y = f(x)$ – definition, first principle as

$$\lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h} \quad \text{and also provide standard notations to denote the derivative}$$

of a function.

- 17.2 State the significance of derivative in scientific and engineering applications.
- 17.3 Find the derivatives of elementary functions like x^n , a^x , e^x , $\log x$, $\sin x$, $\cos x$, $\tan x$, $\sec x$, $\csc x$ and $\cot x$ using the first principles.
- 17.4 Find the derivatives of simple functions from the first principle .

- 17.5 State the rules of differentiation of sum, difference, scalar multiplication, product and quotient of functions with illustrative and simple examples.
- 17.6 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples such as
- (i) $\sqrt{t^2 + \frac{2}{t}}$ (ii) $x^2 \sin 2x$ (iii) $\frac{x}{\sqrt{x^2 + 1}}$ (iv) $\log(\sin(\cos x))$.
- 17.7 Find the derivatives of Inverse Trigonometric functions and examples using the Trigonometric transformations.
- 17.8 Explain the method of differentiation of a function with respect to another function and also differentiation of parametric functions with examples.
- 17.9 Find the derivatives of hyperbolic functions.
- 17.10 Explain the procedures for finding the derivatives of implicit function with examples.
- 17.11 Explain the need of taking logarithms for differentiating some functions with examples like $[f(x)]^{g(x)}$.
- 17.12 Explain the concept of finding the higher order derivatives of second and third order with examples.
- 17.13 Explain the concept of functions of several variables, partial derivatives and difference between the ordinary and partial derivatives with simple examples.
- 17.14 Explain the definition of Homogenous function of degree n
- 17.15 Explain Euler's theorem for homogeneous functions with applications to simple problems.

UNIT - V

Applications of the Differentiation

18.0 Understand the Geometrical Applications of Derivatives

- 18.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve $y=f(x)$ at any point on the curve.
- 18.2 Explain the concept of derivative to find the slope of tangent and to find the equation of tangent and normal to the curve $y=f(x)$ at any point on it.
- 18.3 Find the lengths of tangent, normal, sub-tangent and sub normal at any point on the curve $y=f(x)$.
- 18.4 Explain the concept of angle between two curves and procedure for finding the angle between two given curves with illustrative examples.

19.0 Understand the Physical Applications of Derivatives

- 19.1 Explain the derivative as a rate of change in distance-time relations to find the velocity and acceleration of a moving particle with examples.
- 19.2 Explain the derivative as a rate measurer in the problems where the quantities like volumes, areas vary with respect to time- illustrative examples.

20.0 Use Derivatives to find extreme values of functions

- 20.1 Define the concept of increasing and decreasing functions.
- 20.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.
- 20.3 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima.
- 20.4 Solve problems on maxima and minima in applications like finding areas, volumes, etc.

21.0 Use Derivatives to find Errors and Approximations

- 21.1 Find the absolute error, approximate error, relative error and percentage error in functions of single variable.

COURSE CONTENT

Unit-I

Algebra

1. Logarithms :

Definition of logarithm and its properties, natural and common logarithms; the meaning of e and exponential function, logarithm as a function and its graphical representation.

2. Partial Fractions :

Rational, proper and improper fractions of polynomials. Resolving rational fractions in to their partial fractions covering the types mentioned below:

$$\begin{array}{ll} i) \frac{f(x)}{(x+a)(x+b)(x+c)} & ii) \frac{f(x)}{(x+a)^2(x+b)(x+c)} \\ iii) \frac{f(x)}{(x^2+a)(x+b)} & iv) \frac{f(x)}{(x+a)(x^2+b)^2} \end{array}$$

Matrices:

3. Definition of matrix, types of matrices-examples, algebra of matrices-equality of two matrices, sum, scalar multiplication and product of matrices. Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Laplace's expansion, properties of determinants. Singular and non singular matrices-Adjoint and multiplicative inverse of a square matrix- examples-System of linear equations in 2 or 3 variables-Solutions by Cramer's rule, Matrix inversion method-examples-Elementary row operations on matrices -Gauss-Jordan method to solve a system of equations.

Unit-II

Trigonometry :

4. **Trigonometric ratios:** definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.
5. **Compound angles:** Formulas of $\sin(A\pm B)$, $\cos(A\pm B)$, $\tan(A\pm B)$, $\cot(A\pm B)$, and related identities with problems.

6. **Multiple and sub multiple angles:** trigonometric ratios of multiple angles $2A, 3A$ and submultiple angle $A/2$ with problems.
7. Transformations of products into sums or differences and vice versa simple problems
8. **Inverse trigonometric functions :** definition, domains and ranges-basic properties-problems.
9. **Trigonometric equations:** concept of a solution, principal value and general solution of trigonometric equations :
 $\sin x = k$, $\cos x = k$, $\tan x = k$.
 Solutions of simple quadratic equations, equations involving usage of transformations-problems.
10. **Properties and solutions of triangles:** relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle-solving a triangle- problems.
11. **Hyperbolic functions:** Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.
12. **Complex Numbers:** Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitude (polar) form, Exponential form (Euler) form of a complex number- Problems. DeMoivre's Theorem and its applications in complex numbers- Simple problems.

UNIT-III

Coordinate geometry

13. **Straight lines:** various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.
14. **Circle:** locus of a point, Circle definition-Circle equation given (i) center and radius, (ii) two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle - finding center, radius.
15. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. Properties of parabola, ellipse and hyperbola, standard forms.

UNIT-IV

Differential Calculus

16. Concept of Limit- Definition- Properties of Limits and Standard Limits -Simple Problems-Continuity of a function at a point- Simple Examples only.

17. Concept of derivative- definition (first principle) - different notations-derivatives of elementary functions - problems. Derivatives of sum, product, quotient, scalar multiplication of functions - problems. Chain rule, derivatives of inverse trigonometric functions, derivative of a function with respect to another function, derivative of parametric functions, derivative of hyperbolic, implicit functions, logarithmic differentiation – problems in each case. Higher order derivatives - examples – functions of several variables – partial differentiation, Euler’s theorem-simple problems.

UNIT-V

Applications of Derivatives:

18. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, sub tangent and subnormal to the curve at any point. Angle between the curves - problems.
19. Physical applications of the derivative – velocity, acceleration, derivative as a rate Measure – Problems.
20. Applications of the derivative to find the extreme values – Increasing and decreasing functions, finding the maxima and minima of simple functions - problems leading to applications of maxima and minima.
21. Applications of derivative in finding errors and approximations of functions and simple problems.

Reference Books :

1. A text book of matrices by Shanti Narayan,
2. Plane Trigonometry, by S.L Loney
3. Co-ordinate Geometry, by S.L Loney
4. Thomas Calculus, Pearson Addison-Wesley publishers
5. Calculus – I, by Shanti Narayan and Manicavachgam Pillai, S.V Publications

ENGINEERING PHYSICS

Subject Title	:	Engineering Physics
Subject Code	:	Common -103
Periods per week	:	04
Total periods per year	:	120

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type	Essay Type
1.	Units and Dimensions	08	03	1	-
2.	Elements of Vectors	12	13	1	1
3.	Kinematics	14	13	1	1
4.	Friction	08	10	-	1
5.	Work, Power and Energy	12	10	-	1
6.	Simple Harmonic Motion	12	13	1	1
7.	Heat & Thermodynamics	12	13	1	1
8.	Sound	12	13	1	1
9.	Properties of matter	10	06	2	-
10.	Electricity & magnetism	12	13	1	1
11.	Modern Physics	08	03	1	-
	Total:	120	110	10	8

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Units and dimensions

- 1.1 Explain the concept of Units
- 1.2 Define the terms
 - a) Physical quantity, b) Fundamental physical quantities and
 - c) Derived physical quantities
- 1.3 Define unit
- 1.4 Define fundamental units and derived units
- 1.5 State SI units with symbols
- 1.6 State Multiples and submultiples in SI system
- 1.7 State Rules of writing S.I. units
- 1.8 State advantages of SI units
- 1.9 Define Dimensions
- 1.10 Write Dimensional formulae
- 1.11 Derive dimensional formulae of physical quantities
- 1.12 List dimensional constants and dimensionless quantities
- 1.13 State the principle of Homogeneity of Dimensions
- 1.14 State the applications of Dimensional analysis
- 1.15 State the limitations of dimensional analysis
- 1.16 Solve problems

2.0 Understand the concept of Elements of Vectors

- 2.1 Explain the concept of Vectors
- 2.2 Define Scalar and Vector quantities
- 2.3 Give examples for scalar and vector quantities
- 2.4 Represent vectors graphically
- 2.5 Classify the Vectors

- 2.6 Resolve the vectors
- 2.7 Determine the Resultant of a vector by component method
- 2.8 Represent a vector in space using unit vectors (i, j, k)
- 2.9 State triangle law of addition of vectors
- 2.10 State parallelogram law of addition of vectors
- 2.11 Illustrate parallelogram law of vectors in case of flying bird and sling.
- 2.12 Derive expression for magnitude and direction of resultant of two vectors
- 2.13 State polygon law of addition of vectors
- 2.14 Explain subtraction of vectors
- 2.15 Define Dot product of two vectors with examples (Work done, Power)
- 2.16 Mention the properties of Dot product
- 2.17 Define Cross products of two vectors with examples (Torque, Linear velocity)
- 2.18 Mention the properties of Cross product.
- 2.19 Solve the related numerical problems

3.0 Understand the concept of Kinematics

- 3.1 Write the equations of motion in a straight line
- 3.2 Explain the acceleration due to gravity
- 3.3 Derive expressions for vertical motion
 - a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
- 3.4 Derive height of a tower when a body projected vertically upwards from the top of a tower.
- 3.5 Explain projectile motion with examples
- 3.6 Explain Horizontal projection
- 3.7 Derive an expression for the path of a projectile in horizontal projection
- 3.8 Explain oblique projection
- 3.9 Derive an expression for the path of projectile in oblique projection
- 3.10 Derive formulae for projectile in oblique projection
 - a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
 - e) Horizontal Range, f) Maximum range
- 3.11 Solve the related numerical problems

4.0 Understand the concept of Friction

- 4.1 Define friction
- 4.2 Classify the types of friction and define
- 4.3 Explain the concept of Normal reaction
- 4.4 State the laws of friction
- 4.5 Define coefficients of friction
- 4.6 Explain the Angle of friction
- 4.7 Derive an expression for acceleration of a body on a rough horizontal surface
- 4.8 Derive an expression for the displacement and time taken to come to rest over a rough horizontal surface
- 4.9 Define Angle of repose
- 4.10 Derive expressions for acceleration of a body on a smooth inclined plane (up and down)
- 4.11 Derive expressions for acceleration of a body on a rough inclined plane (up and down)
- 4.12 List the Advantages and Disadvantages of friction
- 4.13 Mention the methods of minimizing friction
- 4.14 Solve the related numerical problems

5.0 Understand the concepts of Work, Power, and Energy

- 5.1 Define the terms 1. Work, 2. Power and Energy
- 5.2 State SI units and dimensional formulae for 1. Work, 2. Power, and Energy
- 5.3 Define potential energy and state examples
- 5.4 Derive the expression for Potential energy
- 5.5 Define kinetic energy and state examples
- 5.6 Derive the expression for kinetic energy
- 5.7 State and derive Work- Energy theorem
- 5.8 Derive the relation between Kinetic energy and momentum
- 5.9 State the law of conservation of energy and mention examples
- 5.10 Verify the law of conservation of energy in the cases of a freely falling body and vertically projected body in the upward direction
- 5.11 Solve the related numerical problems

6.0 Understand the concept of Simple harmonic motion

- 6.1 Define Simple harmonic motion
- 6.2 Give examples for Simple harmonic motion
- 6.3 State the conditions of Simple harmonic motion
- 6.4 Explanation of SHM in terms of projection of circular motion on any one of the diameters of the circular path
- 6.5 Derive expression for displacement
- 6.6 Derive expression for velocity
- 6.7 Derive expression for acceleration
- 6.8 Derive expression for Time period and frequency of S H M
- 6.9 Define phase of S H M and explain from the expression of displacement
- 6.10 Define Ideal simple pendulum and derive expression for Time period of simple pendulum
- 6.11 State the laws of motion of simple pendulum and mention formulae
- 6.12 Solve the related numerical problems

7.0 Understand the concept of Heat and thermodynamics

- 7.1 Explain the concept of expansion of gases
- 7.2 State and explain Boyle's law and also express it in terms of density
- 7.3 Define absolute zero temperature
- 7.4 Explain absolute scale of temperature
- 7.5 State Charles laws in terms of absolute temperature and explain
- 7.6 Define ideal gas and distinguish from real gas
- 7.7 Derive Ideal gas equation
- 7.8 Define Specific gas constant and Universal gas constant
- 7.9 Explain why universal gas constant is same for all gases
- 7.10 State SI unit and dimensional formula of universal gas constant
- 7.11 Calculate the value of universal gas constant
- 7.12 State the gas equation in different forms (as a function of density and mass)
- 7.13 Distinguish between r and R
- 7.14 State and Explain Isothermal process
- 7.15 State and Explain adiabatic process
- 7.16 Distinguish between isothermal and adiabatic processes
- 7.17 State first and second laws of thermodynamics and state applications
- 7.18 Define specific heats & molar specific heats of a gas and differentiate them
- 7.19 Derive the relation $C_p - C_v = R$ (Mayer's Equation)
- 7.20 Solve the related numerical problems

8.0 Understand the concept of Sound

- 8.1 Define the term sound
- 8.2 Explain longitudinal and transverse wave motion and state differences
- 8.3 Distinguish between musical sound and noise
- 8.4 Explain noise pollution and state SI unit for intensity level of sound
- 8.5 Explain causes of noise pollution
- 8.6 Explain effects of noise pollution
- 8.7 Explain methods of minimizing noise pollution
- 8.8 Explain the phenomenon of beats
- 8.9 State the applications of beats
- 8.10 Define Doppler effect
- 8.11 List the Applications of Doppler effect
- 8.12 Define reverberation and reverberation time
- 8.13 Write Sabine's formula and name the parameters contained
- 8.14 Define and Explain echoes and also state its applications
- 8.15 State conditions of good auditorium
- 8.16 Solve the related numerical problems

9.0 Understand the properties of matter

- 9.1 Define the term Elasticity
- 9.2 Define the terms stress and strain and also define different types of stress and strain
- 9.3 State the units and dimensional formulae for stress and strain
- 9.4 State and explain Hooke's law
- 9.5 Define surface tension and state examples
- 9.6 Explain Surface tension with reference to molecular theory
- 9.7 Define angle of contact
- 9.8 Define capillarity
- 9.9 Write the formula for surface tension based on capillarity and name the parameters
- 9.10 Explain the concept of Viscosity
- 9.11 Mention examples of Viscosity
- 9.12 State Newton's formula for viscous force and explain
- 9.13 Define co-efficient of viscosity and write its units and dimensional formula
- 9.14 Explain the effect of temperature on viscosity of liquids and gases
- 9.15 State Poiseuille's equation for Co-efficient of viscosity and name the physical quantities involved
- 9.16 Solve the related numerical problems

10.0 Understand the concept of Electricity and Magnetism

- 10.1 Explain the concept of Electricity
- 10.2 State Ohm's law and write the formula
- 10.3 Explain Ohm's law
- 10.4 Define specific resistance, conductance and state their units
- 10.5 State Kichoff's laws
- 10.6 Explain Kichoff's laws
- 10.7 Describe Wheatstone's bridge with legible sketch
- 10.8 Derive an expression for balancing condition of Wheatstone's bridge
- 10.9 Describe Meter Bridge experiment for the determination of resistivity with a neat circuit diagram
- 10.10 Write the formula in Meter Bridge to determine specific resistance

- 10.11 Explain the concept of magnetism
- 10.12 State the Coulomb's inverse square law of magnetism
- 10.13 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force
- 10.14 State the Magnetic induction field strength and mention its units and dimensional formula
- 10.15 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field
- 10.16 Derive Magnetic induction field strength at a point on the axial line
- 10.17 Derive Magnetic induction field strength at a point on the equatorial line
- 10.18 Solve the related numerical problems

11.0 Understand the concept of Modern physics

- 11.1 State and Explain Photo-electric effect
- 11.2 Write Einstein's photoelectric equation and explain
- 11.3 State laws of photoelectric effect
- 11.4 Explain the Working of photoelectric cell
- 11.5 List the Applications of photoelectric effect
- 11.6 Recapitulate refraction of light and its laws
- 11.7 Define critical angle
- 11.8 Explain the Total Internal Reflection
- 11.9 Explain the principle and working of Optical Fiber
- 11.10 Mention types of optical fibers
- 11.11 List the applications of Optical Fiber
- 11.12 Define super conductor and superconductivity and mention examples for superconductors
- 11.13 State the properties of superconducting materials
- 11.14 List the applications of superconductors

COURSE CONTENT

1. Units and Dimensions:

Introduction – Physical quantity – Fundamental and Derived quantities – Fundamental and Derived units- SI units –Multiples and Sub multiples – Rules for writing S.I. units- Advantages of SI units – Dimensions and Dimensional formulae- Dimensional constants and Dimensionless quantities- Principle of Homogeneity- Advantages and limitations of Dimensional analysis- - Problems.

2. Elements of Vectors:

Scalars and Vectors –Types of vectors(Proper Vector, Null Vector, Unit Vector, Equal , Negative Vector, Like Vectors, Co-Initial Vectors, Co-planar Vectors and Position Vector).Addition of vectors- Representation of vectors- Resolution of vectors - Parallelogram, Triangle and Polygon laws of vectors–Subtraction of vectors- Dot and Cross products of vectors-Problems

3. Kinematics

Introduction- Concept of acceleration due to gravity- Equations of motion for a freely falling body and for a body thrown up vertically- Projectiles- Horizontal and Oblique projections- Expressions for maximum height, time of flight, range - problems

4. **Friction:**
Introduction to friction- Causes- Types of friction- Laws of friction- Angle of repose- Angle of friction— Motion of a body over a horizontal surface- smooth inclined plane- rough inclined plane- Advantages and disadvantages of friction- Methods of reducing friction – Problems
5. **Work, Power and Energy:**
Work, Power and Energy- Definitions and explanation- potential energy- kinetic energy-Derivations of Potential and Kinetic energies-K.E and Momentum relation - Work-Energy theorem- Law of Conservation of energy- Problems
6. **Simple Harmonic Motion:**
Introduction- Conditions of SHM- Definition- Examples- Expressions for displacement, velocity, acceleration, Time period, frequency and phase in SHM- Time period of a simple pendulum- Laws of simple pendulum-seconds pendulum- Problems
7. **Heat and Thermodynamics:**
Expansion of Gases- Boyle's law- Absolute scale of temperature- Charles laws- Ideal gas equation- Universal gas constant- Differences between r and R - Isothermal and adiabatic processes- Laws of thermodynamics- Specific heats - molar specific heats of a gas –Derivation of Mayer's Equation- Problems
8. **Sound:**
Sound- Nature of sound- Types of wave motion -musical sound and noise- Noise pollution – Causes & effects- Methods of reducing noise pollution- Beats- Doppler effect- Echo- Reverberation-Reverberation time-Sabine 's formula-Conditions of good auditorium- Problems
9. **Properties of matter**
Definition of Elasticity –Definition of stress and strain -the units and dimensional formulae for stress and strain-The Hooke's law- Definition of surface tension- Explanation of Surface tension with reference to molecular theory - Definition of angle of contact - Definition of capillarity -The formula for surface tension based on capillarity - Explanation of concept of Viscosity - Examples for surface tension and Viscosity - Newton's formula for viscous force- Definition of co-efficient of viscosity-The effect of temperature on viscosity of liquids and gases - Poiseuille's equation for Co-efficient of viscosity- The related numerical problems
10. **Electricity & Magnetism:**
Ohm's law and explanation- Specific resistance- Kirchoff 's laws- Wheatstone's bridge - Meter bridge- Coulomb's inverse square law magnetic field- magnetic lines of force-Magnetic induction field strength- magnetic induction field strength at a point on the axial line - magnetic induction field strength at a point on the equatorial line –problems.
11. **Modern Physics;**
Photoelectric effect –Einstein's photoelectric equation-laws of photoelectric effect - photoelectric cell –Applications of photo electric effect- Total internal reflection- fiber optics- -principle and working of an optical fiber-types of optical fibers - Applications of optical fibers- superconductivity - applications

REFERENCE BOOKS

1. Intermediate physics Volume-I & 2
2. Unified physics Volume 1,2,3 and 4
3. Text book of physics Volume I
4. Text book of applied physics
5. Fibre optics
6. NCERT Text Books ----- XI & XII Standard

Telugu Academy (English version)
 Dr.S.L Guptha and Sanjeev Guptha
 Resnick & Holiday
 Dhanpath Roy
 D.A Hill

Blue Print for setting question paper at different levels

S.No	Major Topics	No. of Periods	Weightage of Marks	Short answer type			Essay type		
				K	U	A	K	U	A
1.	Units and Dimensions	08	03	1	0	0	0	0	0
2.	Elements of Vectors	12	13	0	0	1	0	1	0
3.	Kinematics	14	13	0	1	0	1	0	0
4.	Friction	08	10	0	0	0	0	1	0
5.	Work, Power and Energy	12	10	0	0	0	0	1	0
6.	Simple Harmonic Motion	12	13	0	0	1	0	1	0
7.	Heat & Thermodynamics	12	13	0	1	0	1	0	0
8.	Sound	12	13	0	1	0	0	0	1
9.	Properties of Matter	10	06	1	1	0	0	0	0
10.	Electricity & magnetism	12	13	0	1	0	0	1	0
11.	Modern Physics	08	03	1	0	0	0	0	0
	Total:	120	110	3	5	2	2	5	1

**C – 16, ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES
(Common to all Branches)**

Subject Title : **Engineering Chemistry & Environmental Studies**
Subject Code : **Common-104**
Periods per week : **04**
Total periods per year : **120**

Scheme of instruction and examination Time Schedule

S.No	Major topic	No of Periods	Weight age of marks	Short type (3marks)			Essay type (10 marks)			remarks
				R	U	A	R	U	A	
A. ENGINEERING CHEMISTRY										
1	Fundamentals of Chemistry	18	16	1	0	1	0	1	0	
2	Solutions	10	8	1	0	0	0	0	1/2	5 mark
3	Acids and bases	10	8	0	0	1	0	1/2	0	5 mark
4	Principles of Metallurgy	10	10	0	0	0	1	0	0	
5	Electrochemistry	14	13	0	1	0	0	0	1	
6	Corrosion	8	10	0	0	0	0	1	0	
7	Water Technology	14	13	1	0	0	1	0	0	
8	Polymers	12	13	1	0	0	1	0	0	
9	Fuels	6	3	1	0	0	0	0	0	
B. ENVIRONMENTAL STUDIES		18	16	1	1	0	0	1	0	
total		120	110	6	2	2	3	3 1/2	1 1/2	
				18	6	6	30	35	15	

OBJECTIVES

Upon completion of the course the student shall be able to

A. ENGINEERING CHEMISTRY

1.0 Understand the concept of Atomic structure

- 1.1 Explain the charge and mass of fundamental particles of an atom (electron, proton and neutron)
- 1.2 Explain the concept of atomic number and mass number.
- 1.3 State the Postulates of Bohr's atomic theory and its limitations.
- 1.4 Explain the significance of four Quantum numbers.
- 1.5 Explain 1. Aufbau principle, 2 Pauli's exclusion principle 3 Hund's rule.
- 1.6 Define Orbital in an atom.

- 1.7 Draw the shapes of s, p and d - Orbitals .
- 1.8 Distinguish between Orbit and Orbital
- 1.9 Write the electronic configuration of elements up to atomic number 30
- 1.10 Explain the significance of chemical bonding
- 1.11 Explain the Postulates of Electronic theory of valency
- 1.12 Define the types of Chemical bonding viz., Ionic, Covalent bonds.
- 1.13 Explain the types of Chemical bonding viz., Ionic, Covalent bonds with examples.
- 1.14 Explain bond formation in NaCl and MgO.
- 1.15 List Properties of Ionic compounds
- 1.16 Explain bond formation in Hydrogen molecule, Oxygen molecule, and Nitrogen molecule using Lewis dot method.
- 1.17 List Properties of Covalent compounds
- 1.18 Distinguish between properties of ionic compounds and covalent compounds.
- 1.19 Structures of ionic solids-define a) Unit cell b) co-ordination number.
- 1.20 Structures of Unit cells of NaCl and CsCl.
- 1.21 Define the term. Oxidation number.
- 1.22 Calculate the Oxidation Number of underlined atoms in the following examples
a) $\underline{\text{K}}\underline{\text{Mn}}\text{O}_4$ b) $\text{K}_2\underline{\text{C}}\underline{\text{r}}_2\underline{\text{O}}_7$ c) $\underline{\text{H}}\underline{\text{N}}\text{O}_3$ d) $\text{H}_2\underline{\text{S}}\underline{\text{O}}_4$ e) $\underline{\text{C}}\underline{\text{l}}\text{O}_4^-$ f) $\underline{\text{N}}\underline{\text{H}}_4^+$
- 1.23 Differentiate between Oxidation Number and Valency

2.0 Calculate Molarity and Normality of given Solution

- 2.1 Define the terms 1. Solution, 2. Solute and 3. Solvent
- 2.2 Classify solutions based on physical state and solubility
- 2.3 Define mole
- 2.4 Problems on 'Mole concept'
- 2.5 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight
- 2.6 Calculate Molecular weight and Equivalent weight of given Acids, (HCl, H₂SO₄, HNO₃) Bases (NaOH, KOH, Ca(OH)₂) and Salts (NaCl, Na₂CO₃, CaCO₃)
- 2.7 Define 1. Molarity, 2. Normality of solutions
- 2.8 Solve Numerical problem on Molarity and Normality
 - a) calculate the Molarity or Normality if weight of solute and volume of solution are given
 - b) calculate the weight of solute if Molarity or normality with volume of solution are given
 - c) problems on dilution to convert high concentrated solutions to low concentrated solutions

3.0 Understand the concepts of Acids and bases

- 3.1 Explain Arrhenius theory of Acids and Bases
- 3.2 State the limitations of Arrhenius theory of Acids and Bases
- 3.3 Explain Bronsted – Lowry theory of acids bases
- 3.4 State the limitations of Bronsted – Lowry theory of acids bases
- 3.5 Explain Lewis theory of acids and bases
- 3.6 State the limitations of Lewis theory of acids and bases
- 3.7 Explain the Ionic product of water
- 3.8 Define pH and explain Sorens on scale
- 3.9 Solve the Numerical problems on pH(Strong Acids and Bases)
- 3.10 Define Buffer solution
- 3.11 Give atleast three examples for Buffer solutions
- 3.12 State the applications of Buffer solution

4.0 Understand the Principles of Metallurgy

- 4.1 List at least eight Characteristics of Metals
- 4.2 Distinguish between Metals and Non Metals
- 4.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Fluxand 5.Slag
- 4.4 Describe the methods of concentration of Ore; 1.Handpicking,2.Levigation, and 3. Froth Floatation
- 4.5 Describe the methods involved in extraction of crude metal- Roasting, Calcination and Smelting.
- 4.6 Explain the purification of Metals by Electrolytic Refining
- 4.7 Define an Alloy
- 4.8 Write the Composition of the following alloys:1.Brass, 2.Germansilver, 3 Nichrome
- 4.9 List the uses of the following Alloys: 1. Brass, 2.Germansilver, 3.Nichrome

5.0 Understand the concepts of Electrochemistry

- 5.1 Define the terms1. Conductor, 2. Insulator, 3.Electrolyte 4.Non–electrolyte
- 5.2 Distinguish between metallic conduction and Electrolytic conduction
- 5.3 Explain electrolysis by taking example fused NaCl
- 5.4 Explain Faraday's laws of electrolysis
- 5.5 Define 1. Chemical equivalent (E) 2. Electrochemical equivalent (e) and their relation.
- 5.6 Solve the Numerical problems based on Faraday's laws of electrolysis
- 5.7 Define Galvanic cell
- 5.8 Explain the construction and working of Galvanic cell
- 5.9 Distinguish between electrolytic cell and galvanic cell
- 5.10 Explain the electrode potentials and standard electrode potentials
- 5.11 Explain the electro chemical series and its significance

- 5.12 Explain the emf of a cell.
- 5.13 Solve the numerical problems on emf of the cell based on standard electrode potentials.

6.0 Understand the concept of Corrosion

- 6.1 Define the term corrosion
- 6.2 state the Factors influencing the rate of corrosion
- 6.3 Describe the formation of a) composition cell, b) stress cell, c) concentration cell during corrosion.
- 6.4 Define rusting of iron and Explain the mechanism of rusting of iron.
- 6.5 Explain the methods of prevention of corrosion:
 - a) Protective coatings (anodic and cathodic coatings)
 - b) Cathodic protection (Sacrificial anode process and Impressed-voltage process)

7.0 Understand the concept of Water Technology

- 7.1 State the various Sources of water like Surface water and sub-surface water.
- 7.2 Define the terms soft water and hard water with respect to soap consumption.
- 7.3 Define the term hardness of water
- 7.4 Types of hardness of water 1. Temporary hardness 2. Permanent hardness
- 7.5 List the salts that causing hardness of water (with Formulae)
- 7.6 State the disadvantages of using hard water in industries
- 7.7 Define Degree of hardness, units of hardness (mg/L) or ppm.
- 7.8 Explain the methods of softening of hard water: a) Ion-Exchange process, b) Permutit process or zeolite process
- 7.9 Concept of Osmosis and Reverse Osmosis with examples .
- 7.10 State the applications of Reverse Osmosis.
- 7.11 State essential qualities of drinking water.

8.0 Understand the concepts of Polymers

- 8.1 Explain the concept of polymerisation
- 8.2 Describe the methods of polymerization a) addition polymerization of Ethylene b) condensation polymerization of phenol and formaldehyde (Only flow chart i.e. without chemical equations)
- 8.3 Define the term plastic
- 8.4 Classify the plastics with examples
- 8.5 Distinguish between the thermo and thermo setting plastics
- 8.6 List the Characteristics of plastics
- 8.7 State the advantages of plastics over traditional materials
- 8.8 State the disadvantages of using plastics.

- 8.9 Explain the methods of preparation of the following plastics:
1.Polythene, 2. PVC, 3.Teflon, 4. Polystyrene and 5. Urea formaldehyde
- 8.10 Explain the uses of the following plastics:
1.Polythene, 2. PVC, 3.Teflon, 4.Polystyrene and 5. Urea formaldehyde
- 8.11 Define the term natural rubber
- 8.12 write the structural formula of Natural rubber
- 8.13 Explain the processing of Natural rubber from latex
- 8.14 List the Characteristics of natural rubber
- 8.15 Explain the process of Vulcanization
- 8.16 List the Characteristics of Vulcanized rubber
- 8.17 Define the term Elastomer
- 8.18 Describe the preparation of the following synthetic rubbers a) Buna-s and b)Neo prene rubber
- 8.19 List the uses of the following synthetic rubbers a) Buna-s and b)Neo prene rubber

9.0 Understand the concepts of Fuels

- 9.1 Define the term fuel
- 9.2 Classify the fuels based on physical state—solid, liquid and gaseous fuels,
- 9.3 Classify the fuels based on occurrence-primary and secondary fuels
- 9.4 List the characteristics of good fuel
- 9.5 State the composition and uses of gaseous fuels:
a)water gas, b)producer gas, c)natural gas, d)coal gas, e)Biogas and f) acetylene

B. ENVIRONMENTAL STUDIES

- 1.1 Define the term environment
- 1.2 Explain the scope and importance of environmental studies
- 1.3 Segments of environment 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere,
- 1.4 Define the following terms 1)Pollutant, 2).Pollution, 3).Contaminant, 4)receptor, 5)sink, 6) particulates, 7)dissolved oxygen, 8)Threshold limit value, 9).BOD, and 10).COD 11) eco system .
- 1.5 State the renewable and non renewable energy sources with examples.
- 1.6 Define the terms:
1).Producers, 2).Consumers and 3).Decomposers with examples.
- 1.7 Explain bio diversity and threatst obiodiversity
- 1.8 Define air pollution
- 1.9 Classify the air pollutants-based on origin and physical state of matter.
- 1.10 Explain the causes of Air pollution.
- 1.11 Explain the effects of air pollution on human beings, plants and animals.
- 1.12 State the uses of forest resources.

- 1.13 State the deforestation and its causes and effects.
- 1.14 Explain the 1.) Green house effect , 2) Ozone layer depletion and 3) Acidrain.
- 1.15 Explain the methods of control of Air pollution
- 1.16 Define Water pollution
- 1.17 Explain the causes of Water pollution
- 1.18 Explain the effects of Water pollution on living and Non-living things.
- 1.19 Explain the methods of control of Water pollution.

COURSE CONTENT

A. ENGINEERING CHEMISTRY

1. Fundamentals of Chemistry

Atomic Structure: Introduction - Fundamental particles – Bohr's theory – Quantum numbers – Aufbau principle - Hund's rule - Pauli's exclusion Principle- Orbitals, shapes of s, p and d orbitals - Electronic configurations of elements

Chemical Bonding: Introduction – types of chemical bonds – Ionic and covalent bond with examples–Properties of Ionic and Covalent compounds- structures of ionic crystals NaCl, CsCl.

, **Oxidation Number**- calculations, differences between Oxidation Number and Valency.

2. Solutions

Introduction-concentration methods – Mole concept, Molarity, Normality, Equivalent weights, Numerical problems on Mole, Molarity and Normality.

3. Acids and Bases

Introduction – Theories of acids and bases and limitations – Arrhenius theory- Bronsted –Lowry theory – Lewis acid base theory – Ionic product of water– pH and related numerical problems–Buffer solutions–Applications.

4. Principles of Metallurgy

Characteristics of Metals and distinction between Metals and Non Metals, Metallurgy, ore, Gangue, Flux, Slag - Concentration of Ore –Hand picking, Levigation, Froth floatation – Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of Brass, German silver and Nichrome

5. Electrochemistry

Conductors, insulators, electrolytes– electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electrochemical series–emf and numerical problems on emf of a cell

6. Water technology

Introduction–soft and hard water–causes of hardness–types of hardness
–dis advantages of hard water – degree of hardness (ppm) – softening methods –
permut it process – ion exchange process– drinking water –Osmosis, Reverse Osmosis
–Applications of Reverse osmosis

7. Introduction - factors influencing corrosion - composition, stress and concentration
cells–rusting of iron and its mechanism – prevention of corrosion by coating methods,
cathodic protection

8. Polymers

Introduction – polymerization – types of polymerization – addition, condensation
with examples – plastics – types of plastics – advantages of plastics over traditional
materials –Disadvantages of using plastics –
preparationandusesofthefollowingplastics:1.Polythene 2.PVC 3.Teflon 4.Polystyrene 5.
Urea formal dehyde – Rubber – Natural rubber – processing from latex –Vulcanization
– Elastomers, Buna-s, Neoprene rubber and their uses.

9. Fuels

Definition and classification of fuels–characteristics of good fuel-composition and uses
of gaseous fuels.

B. ENVIRONMENTAL STUDIES

Introduction– environment –scope and importance of environmental studies important
terms– renewable and non-renewable energy sources–Concept of ecosystem,
producers, consumers and decomposers – Biodiversity, definition and threats to Bio
diversity.

Air pollution – causes-Effects– forest resources: uses and over exploitation,
deforestation, acid rain, greenhouse effect –ozone depletion – control of air pollution –
Water pollution – causes – effects – control measures,

REFERENCE BOOKS

- | | | |
|----|--------------------------------|---------------------------------------|
| 1. | Intermediate chemistry Vol 1&2 | Telugu Academy |
| 2. | Intermediate chemistry Vol 1&2 | Vikram Publishers |
| 3. | Intermediate chemistry Vol 1&2 | Vignan Publishers &Deepthi Publishers |
| 4. | Engineering Chemistry | Jain & Jain |
| 5. | Engineering Chemistry | O.P. Agarwal, Hi-Tech. |
| 6. | Engineering Chemistry | Sharma |
| 7. | Engineering Chemistry | A.K. De |

BASIC ELECTRICAL ENGINEERING

Subject Title : **Basic Electrical Engineering.**
Subject Code : **BM -105**
Periods / week : **04**
Periods / semester : **120**

TIME SCHEDULE

S. No	Major Topics	No. of Periods	Weightage of Marks	Short type	Essay type
1	Basic principles of electricity	15	13	1	1
2	D.C. Networks	12	13	1	1
3	Magnetism and Electromagnetism	20	21	2	11/2
4	Electromagnetic Induction	18	16	2	1
5	Heating effects of Electric current	12	8	1	1/2
6	Electrostatics	18	13	1	1
7	A.C Fundamentals	25	26	2	2
		120	110	10	08

OBJECTIVES:

Up on the completion of the course student shall be able to:

1.0 Comprehend the Basic principles of electricity

- 1.1 Explain structure of Atom , electronic configuration of elements.
- 1.2 Define Valence electron; distinguish between Conductors, Insulators and Semiconductors with reference to valence electrons.
- 1.3 Explain the concept of electric Charge, state SI unit for charge.
- 1.4 Explain the concept of Potential, Potential Difference and E.M.F Mention their S.I. Units.
- 1.5 Explain the concept of electric Current and differentiate between conventional electric current and electron current.
- 1.6 State and explain Ohm's law.
- 1.7 Explain the concept of electrical Resistance and Conductance and their S.I. Units
- 1.8 State parameters affecting the resistance

- 1.9 Define Specific resistance and state its S.I. Unit.
- 1.10 Explain Temperature Coefficient of resistance and solve simple problems on variation of resistance with temperature.
- 1.11 Explain the concepts of Work done, Energy expended and Power dissipated in electric circuit and state S.I. Units of Work, Power and Energy
- 1.12 Solve simple Domestic electricity bill.
- 1.13 Derive the formula for equivalent resistance when resistances are connected in series, parallel and series-parallel.
- 1.14 Solve problems on series, parallel and series-parallel circuits for total current, branch current, power, and p.d. across and in part of the circuit.

2.0 Comprehend the D.C. Networks

- 2.1 Explain the concept of electrical Network.
- 2.2 Define the terms
(i) electric Circuit, (ii) Branch, (iii) Node, (iv) loop, (v) Active element and (vi) Passive element.
- 2.3 State and explain Kirchhoff's laws.
- 2.4 Solve problems on D.C. Networks using Kirchhoff's laws.
- 2.5 Apply Kirchhoff's laws to Wheatstone's bridge Network.
- 2.6 Explain Star and Delta configurations of resistances.
- 2.7 Give transformation formulae from Star to Delta & Delta to Star (no derivation).
- 2.8 Solve simple problems on Star/Delta and Delta/Star transformation.

3.0 Explain the Concept of Magnetism and Electromagnetism

- 3.1 Explain the Magnetism and magnetic Fields. Sketch field pattern of Bar magnet.
- 3.2 State Coulomb's laws of magnetism.
- 3.3 Define the terms Absolute and Relative Permeability of medium.
- 3.4 Explain the concept of Lines of force & Magnetic Field.
- 3.5 Define field Intensity, Magnetic potential, Flux, Flux density.
- 3.6 Explain the concept of Electromagnetic effect
- 3.7 Draw and explain the field patterns due to Straight current carrying conductor.
- 3.8 Explain Work law and its applications.
- 3.9 State Laplace law (Biot-Savart's Law).
- 3.10 Give expressions for field strength due to long current carrying conductor,
- 3.11 Develop the expression for magnitude of the force on a current carrying conductor placed inside a magnetic field.
- 3.12 State the Fleming's Left Hand rule.
- 3.13 Give the expression for the force between two parallel current carrying conductors
- 3.14 Develop the concept of Magnetic circuits
- 3.15 Define Magneto Motive Force (mmf), Permeability, Flux and Reluctance
- 3.16 Solve problems on simple magnetic circuits
- 3.17 Compare Magnetic circuit with Electric circuit
- 3.18 Explain the terms leakage Flux and leakage Co-efficient
- 3.19 Sketch the general shape of magnetization curve for magnetic material.
- 3.20 Explain Hysteresis loop and Hysteresis loss.
- 3.21 Explain Eddy current loss.

4.0 Explain the Concept of Electromagnetic Induction:

- 4.1 Define and explain Faraday's laws of Electromagnetic Induction,

- 4.2 Illustrate the types of induced EMFs and differentiate them.
- 4.3 Define Lenz's law.
- 4.4 Derive the expression for Dynamically induced E.M.F. and solve related problems.
- 4.5 Explain the terms Self inductance and Mutual inductance and differentiate them.
- 4.6 Derive expressions for Self and Mutual inductance in terms of physical parameters.
- 4.7 Define the Co-efficient of coupling for a given circuit.
- 4.8 Find the Equivalent inductance when inductances are connected in series.
- 4.9 Derive the formula for energy stored in a magnetic field.

5.0 Appreciate the Heating effects of Electric current

- 5.1 Explain Heating effects of electric current.
- 5.2 State and explain Joule's law.
- 5.3 Define latent heat and specific heat
- 5.4 Explain the working of electrical appliances like
 - i. Incandescent bulb
 - ii. Electric kettle
 - iii. Electric Iron
 - iv. Geyser

6.0 Appreciate the concept of Electrostatics:

- 6.1 State Coulomb's Laws of Electrostatics
- 6.2 Define Absolute Permittivity and Relative Permittivity of a medium.
- 6.3 Solve problems on Inverse Square Laws as applied to electrostatics.
- 6.4 Explain Electrostatic Induction
- 6.5 Comprehend electrostatic Field and electrostatic Lines of force.
- 6.6 List the properties of electrostatic lines of force.
- 6.7 Define Field strength in terms of force per unit charge
- 6.8 Define electric Flux, Flux density and derive the relation $D = \epsilon_0 \epsilon_r E$
- 6.9 State Gauss's Theorem (proof is not required).
- 6.10 Explain the charge residing outside the surface of a sphere.
- 6.11 Solve problems on field strength (or field intensity or electric intensity) and flux density

- 6.12 Define electric Potential, Potential Difference in electric fields and obtain an expression for potential due to point charge.
- 6.13 Explain the Di-electric strength and state the importance of Di-electric constant.
- 6.14 Define Capacitance and give its S.I. Unit.
- 6.15 Obtain the expressions for capacitance of a parallel plate capacitor with Uniform Di-electric medium and with Composite Medium.
- 6.16 Derive Equivalent capacitance of series, parallel and series-parallel combinations of capacitors.
- 6.17 Calculate the Energy stored in a capacitor.
- 6.18 Solve the problems on calculation of Equivalent capacitance and Energy stored in a capacitor.

7.0 Comprehend the A.C Fundamentals:

- 7.1 Define the terms pertaining to alternating quantities (i) Wave form, (ii) Cycle, (iii) Time period, (iv) Frequency, (v) Amplitude.
- 7.2 Explain single loop Generator concept.
- 7.3 State the relation between Poles, Speed and Frequency.
- 7.4 State the Instantaneous value in terms of Maximum value, Frequency and Time.
- 7.5 State and calculate the Average value, R.M.S. value, Form factor and Peak factor for sine wave and half-wave rectified sine wave.
- 7.6 Explain the terms Phase and Phase difference.
- 7.7 Use 'J' Operator to perform Phasor algebra (addition, subtraction, multiplication and Division)
- 7.8 Convert Polar quantities to Rectangular quantities and vice versa.
- 7.9 Explain the concepts of single phase A.C. Circuits.
- 7.10 Derive relationship between voltage and current, power consumed in pure Resistive, Inductive and Capacitive circuits with vector diagrams.
- 7.10 Derive relationship between voltage and current, power consumed and power factor in R - L, R-C, L-C and R - L-C series circuits.
- 7.11 Simple problems on R-L, R-C, L-C and R-L-C series circuits.

COURSE CONTENTS

1. Basic principles of electricity:

Atomic Structure, Differences between Conductors, Insulators and Semi conductors, Concept of Electric Charge, Concept of Potential, Concept of Electric Current. Ohms law, Concept of Electrical resistance, parameters affecting resistance, Specific resistance, Temperature Co-efficient, Work Power and Energy, Series, parallel and Series-Parallel circuits.

2. D.C. Networks:

Network terminology-Network solutions by Kirchhoff's laws, Wheat stone's bridge network- its applications Star/Delta transformation- Problems.

3. Magnetism and Electromagnetism:

Electromagnetic Effect, Magnetic fields, Field patterns, Permeability, Flux, Flux density, Susceptibility, comparison between Electrostatic and Magnetic lines of force and Eddy current losses. Work law, Biot-savarts' law, Fleming's Left Hand rule, MMF, Reluctance, Hysteresis loss.

4. Electromagnetic Induction:

Faraday's laws, Lenz's Law, Dynamically induced EMF, Statically induced EMF, Self and Mutual Inductance, Co-efficient of coupling, Series connection of inductances, Energy stored in magnetic field.

5. Heating effects of Electric current:

Define Mechanical equivalent of heat. Define Joule's Law, Latent heat, Specific heat, working of different electrical appliances

6. Electrostatics:

Laws of Electrostatics, Permittivity – Relative and Absolute, electric Fields, Potential and Potential Difference, Gauss's theorem, Flux, Flux density, Electric Intensity, Di-electric strength, concept of Capacitance, Capacitances in series, parallel and series- parallel combination, Energy stored in a capacitor.

7.A.C Fundamentals:

Single loop Generator concept, Poles, Speed and Frequency, RMS value, Average value and terms associated with sine wave, j-notation, Polar to Rectangular conversions and vice versa, RL, RC, LC, RLC series circuits

REFERENCES:

1. Electrical Technology by H. Cotton
2. A Text Book of Electrical Technology, Vol.I – B.L.Theraja& A.K. Theraja
- 3 Introduction to Basic Elec. Engg. By V.K. Mehta
4. Basic Electrical Engineering by J.B. Gupta.
5. Electrical Technology by P.S. Duggal

ELECTRONIC COMPONENTS & DEVICES

Subject Title : **ELECTRONIC COMPONENTS & DEVICES**
Subject Code : **BM- 106**
Periods / week : **04**
Periods /Semester : **120**

TIME SCHEDULE

S.No	Major Topic	No. of Periods	Weightage of Marks	No. of Short Qns	No. of Essay Qns
1.	Electronic passive Components	15	13	1	1
2	Switches, relays, batteries and PCB's	10	8	1	1/2
3	Semiconductor Physics	12	8	1	1/2
4	Semiconductor Diodes	15	16	2	1
5	Rectifiers	15	13	1	1
6	Transistor and its Characteristics	15	13	1	1
7	Transistor Biasing Circuits	18	16	2	1
8	Field Effect Transistors and Special Semiconductor Devices	20	23	1	2
		120	110	10	8

OBJECTIVES:

On completion of the study of the subject a student should be able to comprehend the following:

1.0 Know different types of Electronic Passive Components.

- 1.1 Define different types of materials. Give examples for Conductors, Semiconductors and Insulators
- 1.2 Define Active and Passive elements
- 1.3 Define Resistance and Resistivity of a material
- 1.4 Classify the types of Resistors: fixed, variable, carbon, metal film and wire wound resistors.
- 1.5 List the ratings of a Resistor.
- 1.6 Explain Resistor color coding for Carbon and Metal Film Resistors.
- 1.7 Explain the features of above Resistors with respect to Size, Power Rating and Tolerance.
- 1.8 List the applications of the above Resistors.

- 1.9 Mention special purpose Resistors LDR, VDR, Thermistors and Sensistor.
- 1.10 Explain the principle of LDR (Photo Conductivity)
- 1.12 Explain the construction of LDR.
- 1.13 Draw and explain the characteristics of LDR.
- 1.14 List any three applications of LDR like Twilight switch, optical counter
- 1.15 Draw and explain characteristics of VDR.
- 1.16 Define capacitor and capacitance.
- 1.17 Explain charging and discharging of a capacitor.
- 1.18 List the factors affecting Capacitance and Voltage rating.
- 1.19 Define dielectric constant and dielectric strength of a capacitor.
- 1.20 Classify the Capacitors.
- 1.21 List their applications and ranges.
- 1.22 Give the color code for Tubular Ceramic capacitor and Disc capacitor.
- 1.23 Mention the losses in a capacitor
- 1.24 Define Inductor and Self Inductance, Mutual Inductance.
- 1.25 Define Transformer.
- 1.26 Explain the principle of a Transformer.
- 1.27 Classify the Transformers based on the applications (Power, AF& RF, Iron core & Ferrite)
- 1.28 List any 3 applications for the above

2.0 Familiarize different types of switches, relays, batteries and PCB's

- 2.1 Explain the working of a switch.
- 2.2 Classify Switches according to poles and throws: SPST, SPDT, DPST, DPDT and multi pole multi throw.
- 2.3 Explain the working of toggle, push button, rotary, slide, keyboard and thumbwheel switches.
- 2.4 Define relay and classify them.
- 2.5 Explain the construction and working of Electromagnetic Relay.
- 2.6 Define storage Batteries.
- 2.7 Give battery or cell Classification, Differences between Primary and Secondary Cell
- 2.8 Explain the differences between Conventional circuits and Printed Circuit Boards.
- 2.9 Classify the PCB's.
- 2.10 List various types of laminates used in PCB's.
- 2.11 Mention the methods of layout preparation of PCB's.
- 2.12 List the steps involved in PCB manufacturing processes.
- 2.13 State the advantages of PCBs.

3.0 Understand Semiconductor Physics.

- 3.1. Describe the atomic structure of Germanium and Silicon semi conductor Materials.
- 3.2. Explain energy levels and energy bands in solids.
- 3.3. Explain the difference between Conductor, Semi Conductor and Insulator on the basis of Energy band structure with illustration.
- 3.4. List the properties of Semi Conductors and effect of Temperature on Semi Conductors.

- 3.5. Define Doping.
- 3.6. Differentiate between Intrinsic and Extrinsic Semi Conductors.
- 3.7. Describe the formation of N-type and P-type materials.
- 3.8. Explain hole Current due to majority carriers and minority carriers.
- 3.9. Explain drift current and diffusion current.
- 3.10. Compare drift and diffusion currents.

4.0 Understand the properties of PN Diode and Zener Diode.

- 4.1 Explain the formation of P-N junction and its properties.
- 4.2 Explain the concept of potential barrier.
- 4.3 Describe the operation of P-N Junction diode with forward bias and reverse bias.
- 4.4 Draw the Symbol of a P-N Junction diode and give its specifications.
- 4.5 Draw the V-I characteristic of a P-N Junction diode and explain each region.
- 4.6 Estimate the forward/ reverse resistance of the Diode from the characteristic curve.
- 4.7 State the effect of temperature on the Forward and Reverse Characteristics of a P-N junction diode.
- 4.8 Give the Symbol of Zener diode and also give its applications.
- 4.9 Draw the V-I characteristics of Zener diode and explain them.
- 4.10 Distinguish between Zener breakdown and Avalanche breakdown.

5.0 Describe the working principle of Rectifiers.

- 5.1 Differentiate between DC power supplies and Battery.
- 5.2 Define Rectifier. Classify the Rectifiers.
- 5.3 Explain the working of HWR.
- 5.4 Derive expressions for V_{dc} , I_{dc} , V_{rms} , I_{rms} , efficiency, ripple factor and regulation.
- 5.5 Define the PIV rating of the Rectifier diode and state its importance.
- 5.6 Explain the working of FWR using center tapped transformer.
- 5.7 Derive the expression for V_{dc} , I_{dc} , V_{rms} , I_{rms} , efficiency and ripple factor for FWR.
- 5.8 Explain the working of FW Bridge rectifier.
- 5.9 Explain the regulation characteristics of FWR.
- 5.10 Identify the reasons for poor regulation in rectifier circuits.
- 5.11 Compare the performance parameters of HWR & FWR.
- 5.12 Explain the need for a filter circuit in rectifiers.
- 5.13 Explain C, LC & CLC type filter circuits
- 5.14 Explain simple Zener Voltage Regulator.
- 5.15 Draw the block diagram and explain working of regulated power supply.

6.0 Understand Basics of a Transistor and its characteristics

- 6.1 Name the terminals of the transistor
- 6.2 Explain the purpose of emitter, base and collector
- 6.3 Draw the Symbols of NPN and PNP transistors.
- 6.4 Explain construction and working of NPN and PNP transistor.
- 6.5 Give the specifications of Transistor
- 6.4 Mention three basic different packaging and encapsulation used for Transistor

- 6.5 List the configurations of a transistor.
- 6.6 Identify the Circuits for C.B, C.E and C.C configurations.
- 6.7 Define Alpha, Beta factors of a transistor.Explain their significance
- 6.8 Derive the relation between Alpha and Beta
- 6.9 Explain the input and output characteristics of transistors in CB, CE and CC mode.
- 6.10 Derive the expressions for the collector current in CB and CE configurations in terms of I_c , I_e and I_{cbo} and I_{ceo} .
- 6.11 Compare the characteristics of CB, CE and CC.

7.0 Understand function of Transistor biasing circuits.

- 7.1 Explain Transistor as an Amplifier
- 7.2 Explain load line analysis. a) dc load line b) ac load line
- 7.3 Explain the Concept of stability of operating point
- 7.4 Explain the need for transistor biasing.
- 7.5 List out the different biasing techniques
- 7.6 Draw the transistor amplifier circuits with fixed bias, collector to base bias, potential divider bias.
- 7.7 Explain how biasing is provided in the above circuits.
- 7.8 Define stability factor
- 7.9 Explain the compensating methods of bias stability.

8.0 Understand Field Effect Transistors and Special Semiconductor devices.

- 8.1 Draw symbol of FET name the terminals.
- 8.2 Explain construction of JFET.
- 8.3 Describe the working of a JFET.
- 8.4 Draw the drain characteristics for JFET.
- 8.5 State the merits and demerits of a FET over BJT.
- 8.6 Define 'g_m' factor of a FET.
- 8.7 Give the applications of FET.
- 8.8 Describe the working of a MOSFET (Enhancement mode and Depletion mode)
- 8.10 Explain the working principle of Tunnel diode.
- 8.11 Sketch the Symbol of Tunnel diode and mention its applications.
- 8.12 Draw the equivalent CKT of UJT and explain its operation.
- 8.13 Draw UJT characteristics and explain significance of negative resistance region.
- 8.14 State the applications of UJT.
- 8.15 Sketch the symbol of SCR.
- 8.16 Draw the construction of SCR and explain its operation.
- 8.17 Draw and explain V-I characteristics of SCR (Forward and Reverse)
- 8.18 State the applications of SCR.

9.0 Understand analysis of transistor amplifier

- 9.1 Classify the amplifier on the basis of active device used, configuration, frequency range, function of the circuit(voltage & power), types of coupling, types of load, period of conduction.
- 9.2 Define h- parameters

- 9.3 Sketch the h-parameter model for a transistor in CE, CB, and CC configuration.
- 9.4 Sketch the approximate h-parameter model
- 9.5 Derive expression for voltage gain, current gain, input impedance and output impedance for CE, CB, and CC configuration by using approximate model.
- 9.6 Solve simple problems.
- 9.7 Limitations of h- parameters
- 9.8 Sketch the hybrid pi-model for transistor at high frequencies.
- 9.9 Define alpha cut off frequency and Beta cut off frequency.

COURSE CONTENTS

1 Electronic passive Components.

Conductors, Semiconductors, Insulators and dielectric materials. Resistance and Resistivity, ratings of a Resistor, Classification of the Resistors. NTC, PTC, LDR and VDR characteristics, color-coding of Resistors, Capacitor and Capacitance, charging and discharging of a capacitor. Factors affecting capacitance and voltage rating. Classification of capacitors-applications of various Capacitors, Inductors and Transformers- Self Inductance, mutual Inductance. Application of various transformers.

2 Switches, relays, batteries and PCB's

Switches characteristics and their applications. SPST, SPDT, DPST, DPDT and multi pole multi throw Switches, Electromagnetic Relays, storage Batteries, Cell classification, Difference between Primary and Secondary Cells, Conventional circuits and Printed Circuit Boards-advantages of PCB's. Steps involved in PCB manufacturing processes.

3 Semiconductor Physics.

Atomic structure of semi conductor materials. Energy levels and energy bands in solids. Effect of Temperature on Semi conductors, Doping, Intrinsic and Extrinsic Semi conductors. Formation of N-type and P-type semi conducting materials. Drift and Diffusion currents

4 Semiconductor Diodes.

Formation of P- N junction and its properties. concept of potential barrier, operation of P - N Junction diode with Forward bias and Reverse bias. Effect of temperature on the Forward and Reverse Characteristics of P – N junction diode. Zener diode V-I characteristics and its applications. Zener breakdown and Avalanche breakdown, Zener Voltage Regulator. LED, LCD, Varactor diodes, Photo diode and solar cell.

4 Rectifiers and power supplies

Semiconductor diode as a rectifier, Half wave, Full wave and Bridge rectifiers. Definitions of PIV, ripple factor, regulation and rectification efficiency. Type of filter circuits L section and π section filter, Regulated power supply, Zener diode voltage regulator.

5 Transistor characteristics.

Constructional details, Operation, Specifications and Applications of Transistors, I/P and O/P characteristics of transistors in C.B, C.E and C.C configurations. Expressions for the collector current. Alpha, Beta factors of a transistor, Compare CB and CE, CC Configurations.

6 Transistor biasing circuits.

Transistor as an Amplifier, Load line analysis, Concept of stability of operating point, Need for transistor biasing Amplifier circuits with fixed bias, collector to base bias, potential divider bias Stability factor, Compensating methods.

7 Field Effect Transistors and Special Semiconductor devices.

Working of a JFET and MOSFET (Enhancement mode and Depletion mode) with transfer characteristics. Working principle of Tunnel diode, UJT, SCR.

8 Analysis of transistor Amplifier

Classification of amplifiers, h-parameter model for CE, CB, CC configuration, approximate h-parameter model, hybrid π -model, alpha cut off frequency and Beta cut off frequency.

REFERENCE BOOKS

1. Electronic Components and materials by D.V.Prasad.
2. Fundamentals of Electronic Devices by David A. Bell.
3. Electronic circuits by Malvino.
4. Basic Electronics and Linear circuits by N.N. Bhargava, D.C. Kulshreshtha, S.C. Gupta (T.T.T.I) Chandigarh
5. Electronic Components and materials by Madhuri A. Joshi.
6. Integrated Electronics – Milliman&Halkias
7. Electronic Devices and Circuits -Milliman&Halkias.
8. Solid State Electronic Devices – Streetman
9. Introduction to Basic Elec. Engg. By V.K. Mehta
10. A Text Book of Electrical Technology, Vol.I – B.L. Thereja
11. Basic Electrical Engineering by J.B. Gupta.

ENGINEERING DRAWING

Subject Title	:	Engineering Drawing
Subject Code	:	107 (Common to all Branches)
Periods/Week	:	06
Periods Per Year	:	180

Time Schedule

Sno	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	01	-	-	-
2	Engineering Drawing Instruments	05	-	-	-
3	Free hand lettering & Numbering	06	5	1	-
4	Dimensioning Practice	09	5	1	-
5	Geometrical Constructions	21	15	1	1
6	Projection of points, Lines, Planes & Solids	21	10	-	1
7	Auxiliary views	06	5	1	-
8	Sectional views	27	10	-	1
9	Orthographic Projection	33	10	-	1
10	Pictorial drawing	30	10	-	1
11	Development of surfaces	21	10	-	1
	Total	180	80	04	06

The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation

OBJECTIVES

Upon completion of the subject the student shall be able to

1) Understand the basic concepts of Engineering Drawing

- a) State the importance of drawing as an engineering communication medium
- b) State the necessity of B.I.S. Code of practice for Engineering Drawing
- c) Explain the linkages between Engineering drawing and other subjects of study in diploma course

2) Use of Engineering Drawing Instruments

- a) Select the correct instruments and draw lines of different orientation
- b) Select the correct instruments and draw small and large Circles
- c) Select the correct instruments for measuring distances on the drawing
- d) Use correct grade of pencil for different types of lines, thickness and given function
- e) Select and use appropriate scales for a given application
- f) Identify different drawing sheet sizes as per I.S. and Standard Layouts
- g) Prepare Title block as per B.I.S. Specifications
- h) Identify the steps to be taken to keep the drawing clean and tidy

3) Write Free Hand Lettering and Numbers

- a) Write titles using slanting letters and numerals of 7mm, 10mm and 14mm height
- b) Write titles using vertical letters and numerals of 7mm, 10mm and 14mm height
- c) Select suitable sizes of lettering for different layouts and applications

4) Understand Dimensioning Practice

- a) Define "Dimensioning"
- b) State the need of dimensioning the drawing according to accepted standards
- c) Identify notations of Dimensioning used in dimensioned drawing
- d) Identify the system of placement of dimensions in the given dimensioned drawing
- e) Dimension a given drawing using standard notations and desired system of dimensioning
- f) Dimension standard features applying necessary rules
- g) Arrange dimensions in a desired method for a given drawing
- h) Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly

5) Apply Principles of Geometric Constructions

- a) Divide a given line into desired number of equal parts internally
- b) Draw tangent lines and arcs
- c) Use General method to construct any polygon
- d) Explain the importance of conics
- e) Construct ellipse by concentric circles method
- f) Construct parabola by rectangle method
- g) Construct rectangular hyperbola from the given data
- h) Construct involute from the given data
- i) Construct cycloid and helix from the given data
- j) State the applications of the above constructions in engineering practice

6) Apply Principles of Projection of points, lines, planes & solids

- a) Visualize the objects
- b) Explain the I-angle and III-angle projections

- c) Practice the I-angle projections
- d) Draw the projection of a point with respect to reference planes (HP&VP)
- e) Draw the projections of straight lines with respect to two reference planes (cases of lines parallel to one plane and inclined to other plane only)
- f) Draw the projections of planes (cases of planes perpendicular to one plane and inclined to other plane only)
- g) Draw the projections of solids (cases of axis perpendicular to one plane and inclined to other plane only)

7) Understand the need of auxiliary views

- a) State the need of Auxiliary views for a given engineering drawing
- b) Draw the auxiliary views of a given engineering component
- c) Differentiate between auxiliary view and apparent view

8) Appreciate the need of Sectional Views

- a) Explain the need to draw sectional views
- b) Select the section plane for a given component to reveal maximum information
- c) Explain the positions of section plane with respect to reference planes
- d) Differentiate between true shape and apparent shape of section
- e) Draw sectional views and true sections of regular solids discussed in chapter-6 above
- f) Apply principles of hatching

9) Apply principles of orthographic projection

- a) Explain the principles of orthographic projection with simple sketches
- b) Draw the orthographic view of an object from its pictorial drawing
- c) Draw the minimum number of views needed to represent a given object fully

10) Prepare pictorial drawings

- a) State the need of pictorial drawings
- b) Differentiate between isometric scale and true scale
- c) Prepare Isometric views for the given orthographic drawings

11) Interpret Development of surfaces of different solids

- a) State the need for preparing development drawing
- b) Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramids) using parallel line and radial line methods
- c) Prepare development of surface of engineering components like trays, funnels, 90° elbows & rectangular ducts

COURSE CONTENT

NOTE

- 1) B.I.S Specifications should invariably be followed in all the topics.
- 2) A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.
- 3) First Angle Projection is to be followed for all Orthographic projection exercises

1) The importance of Engineering Drawing

Explanation of the scope and objectives of the subject of Engineering Drawing, Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46–1988 – Mention B.I.S - Role of drawing in engineering education – Link between Engineering drawing and other subjects of study

2) Engineering drawing Instruments

Classification: Basic tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mention the names under each classification and their brief description -Scales: Recommended scales reduced & enlarged scales-Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet

Drawing Plate 1: Consisting of two exercises on use of drawing instruments

3) Free hand lettering & numbering

Importance of lettering – Types of lettering -Guide Lines for Lettering- Practicing letters & numbers of given sizes (7mm, 10mm and 14mm) Advantages of single stroke or simple style of lettering

Drawing plate 2: Consisting of five to six exercises on freehand Lettering & Numbering

4) Dimensioning practice

Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape description of an Engineering object - Dimensioning size, Location features, surface finish, fully dimensioned Drawing - Notations or tools of dimensioning, dimension line, extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools - Placing dimensions: Aligned system and unidirectional system (SP-46- 1988) - Arrangement of dimensions: Chain, parallel, combined, progressive, and dimensioning by co-ordinate methods - The rules for dimensioning standard features Circles (holes) arcs, angles, tapers, chamfers, and dimensioning of narrow spaces

Drawing Plate 3: Consisting of 8 exercises on Dimensioning methods and rules

5) Geometric Constructions

Division of a line: to divide a straight line into given number of equal parts internally and it's examples in engineering applications. Construction of tangent lines: to draw tangent lines touching circles internally and externally. Construction of tangent arcs i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles) ii) Tangent arc of given radius touching a circle or an arc and a given line iii) Tangent arcs of radius R, touching two given circles internally and externally Construction of polygon: Construction of any regular polygon of given side using general method. Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and loci of a moving point, Eccentricity of above curves – Their Engg. applications viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process - Construction of ellipse by concentric circles method - Construction of parabola by rectangle method - Construction of rectangular hyperbola - General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering applications, viz, Gear tooth profile, screw threads, springs etc. - their construction.

Drawing Plate 4: Consisting of eight exercises on construction of polygons

Drawing Plate 5: Consisting of eight exercises on construction of conics

Drawing Plate 6: Consisting of eight exercises on involute, cycloid and helix

6) Projection of points, lines, planes & solids

Projecting a point on two planes of projection -Projecting a point on three planes of projection - Projection of straight line i) Parallel to both the planes ii) Perpendicular to one of the planes iii) Inclined to one plane and parallel to other plane - Projection of regular planes- i) Plane perpendicular to HP and parallel to VP and vice versa ii) Plane perpendicular to HP and inclined to VP and vice versa - Projection of regular solids with i) Axis perpendicular to one of the planes ii) Axis parallel to VP and inclined to HP and vice versa

Drawing Plate 7: Consisting of eight exercises on projection of points and Lines

Drawing Plate 8: Consisting of eight exercises on projection of planes

Drawing Plate 9: Consisting of eight exercises on projection of solids

7) Auxiliary views

Need for drawing auxiliary views - Explanation of the basic principles of drawing auxiliary views, explanation of reference plane and auxiliary plane - Partial auxiliary view.

Drawing plate 10: Consisting of four exercises on auxiliary views

8) Sectional views

Need for drawing sectional views – what is a sectional view - Location of cutting plane – Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) - Hatching – Section of regular solids inclined to one plane and parallel to other plane

Drawing Plate 11: Consisting of six exercises on sections of solids

9) Orthographic Projections

Meaning of orthographic projection -Using a viewing box model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object - Concept of front view, top view, and side view, sketching these views for number of engineering objects - Explanation of first angle projection. – Positioning of three views in First angle projection - Projection of points as a means of locating the corners of the surfaces of an object – Use of mitre line in drawing a third view when other two views are given - Method of representing hidden lines - Selection of minimum number of views to describe an object fully

Drawing Plate 12: Consisting of 12 exercises on orthographic projections of engineering objects

10) Pictorial Drawings

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Iso axis, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and ordinary scale-difference between Isometric view and Isometric projection - Isometric and Non-isometric lines - Isometric drawing of common features like rectangles, circular shapes, non-isometric lines - Use of box and offset methods

Drawing plate 13: Consisting of 12 exercises on Isometric views of engineering objects

11) Development of Surfaces

Need for preparing development of surface with reference to sheet metal work -Concept of true length of a line with reference to its orthographic projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal plane and parallel to the other -Development of simple solids like cubes, prisms, cylinders, cones, pyramids -Types of development: Parallel line and radial line development -Procedure of drawing development - drawings of trays, funnels, 90° elbow pipes and rectangular ducts.

Drawing plate 14: Consisting of 5 exercises on development problems

REFERENCE BOOKS

Engineering Graphics by P I Varghese – (McGraw-hill)

Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)

Engineering Drawing by N.D.Bhatt.

T.S.M. & S.S.M on “ Technical Drawing” prepared by T.T.T.I., Madras.

SP-46-1998 – Bureau of Indian Standards.

ELECTRONIC COMPONENTS & DEVICES LAB

Subject title : **ELECTRONIC COMPONENTS & DEVICES LAB**
Subject code : **BM-108**
Periods per week : **6**
Periods / Semester : **180**

TIME SCHEDULE

Sl NO	Major Topics	Periods
1	Study and use of Electronic equipment	15
2	Testing of Electronic components & characteristics	15
3	Soldering practice and Desoldering practice	12
	Semiconductor Diodes	15
5	Rectifiers	15
6	Identification of transistors	12
7	Characteristics of CB configuration	12
8	Characteristics of CE configuration	12
9	Transistor as a switch	12
10	Characteristics of FET	12
11	Characteristics of UJT	12
12	Characteristics of SCR	12
13	Characteristics of LED	12
14	Characteristics of LDR	12

List of the Experiments

1. To study and use of Electronic equipment

- a. Voltmeter, Ammeter, DMM, Analog Multi meter and Regulated Power Supply, CRO.
- b. Measurement of DC Voltage and DC current,
- c. soldering tools.

2. Testing of Electronic components & characteristics

- a. Measure the value of Resistor and verify the value with colour coding
- b. Measurement of capacitance
- c. Measurement of inductance
- d. Test the given transformer

3. Soldering practice and Desoldering practice

4. To draw the forward and reverse characteristics of Silicon diode

- a) Determine Knee voltage, b) identify Cutoff, and Linear regions
- c) Connect a 6V lamp in series with diode and test it on DC power supply
- d) Using the CRO & Curve tracer to observe the Characteristics.
- e) Heat the diode with a soldering Iron and observe the effect on reverse current
- f) To draw the forward& reverse characteristics of Zener diode and determine Breakdown Voltage.
- g) Connect resistance ladder circuit (3 resistors) and measure the voltages at the output by varying input voltage while Zener is reverse biased.

5. To implement Rectifier circuits using Diodes and observe the effect of Filtering

- a) Implementing Half wave rectifier with and without filter
- b) Implementing Full wave rectifier with and without filter
- c) Implementing Bridge rectifier with and without filter
- d) Implementing Voltage Doubler circuit
- e) Connect a diode IN4007 in series with a 230V, 60W Lamp and test it. (Record your observations)

6. Identification of transistors

- a) Identify the transistor and its leads,
- b) Test PNP and NPN transistor with Multimeter

7. Obtain the input and output characteristics of CB configuration and Calculate the dynamic resistance and current gain of NPN / PNP transistors

8. Obtain the input and output characteristics of CE configuration and Calculate the dynamic resistance and current gain of NPN / PNP transistors

9 Transistor as a switch

10 Identification of leads of FET & Obtain the FET drain characteristics and calculate the drain resistance, and the trans-conductance

11 Identify UJT leads& Obtain UJT characteristics and calculate intrinsic stand off ratio.

12. Obtain the SCR Characteristics.

13. Obtain the LED Characteristics.

14. Obtain the LDR Characteristics.

Exp No	Name of the Experiment	Objectives	Key competencies
1	Identifying and drawing Electronic circuit Symbols Identification of meters and equipment	To know the symbols used in Electronic Circuits Identifying the meters and	To know the symbols used in Electronic Circuits Identifying the meters and

	1. DMM, 2. Analog Multimeter, 3. DC Voltmeters/Ammeters 4. DC Power supply 5. DRB 6. DCB 7. DIB 8. CRO 9. Function Generator	equipment Know their purpose	equipment
2	Working with Multimeter a) Measuring the resistance using multimeter b) Testing the wire continuity with multimeter c) Measurement of Battery Voltage using Voltmeter and Multimeter	Identifying analog and Digital multimeters Selecting the correct Range Measuring Voltage, Current and Resistance with Multimeter	Use the Multimeter
3	Connecting batteries in series and parallel and observing the output voltage using DMM	To practice of DMM To practice Series and Parallel connection of Cells Observe the polarity To observe the effect on Terminal Voltage	Make series and parallel connection of batteries Use DMM to measure Voltage
4	Working with Resistors Identify different types of resistors Resistors colour code Connecting resistors in series and parallel and measuring the resistance using multimeter Rheostat connections	Identify different types of resistors Find the value of Resistance from colour code of CFR and MFR types Identifying the terminals on Rheostat, setting the Rheostat to Minimum and maximum positions Observing Resistance change using DMM	Identifying resistance type by observation Finding the value of Resistance from colour code of CFR and MFR types Setting the Rheostat to Minimum and maximum positions
5	Measurement of DC Voltage and DC current	Connecting Voltmeter and Ammeter to measure DC Voltage and Current using Voltmeter and Ammeter	measure DC Voltage and Current using Voltmeter and Ammeter
6	Verification of Ohm's Law	To verify Ohm's law and establish relation between Voltage, Current and Resistance	Perform experiment as per procedure and draw inference
7	Measurement of Resistance using Voltmeter and DRB	Learn to use the DRB Applying Ohm's law in practical situations	Measure the Resistance using Voltmeter and DRB
8	To Verify the laws of Resistance using a Nichrome wire and Multimeter	To understand the laws of Resistance by experimental verification. Reinforce the skills of using Multimeter.	Use the multimeter to measure Resistance
9	Verify the effect of temperature on Resistance Using electric Lamp and Multimeter, Voltmeter and Ammeter	Observing the difference between Cold Resistance and Hot Resistance	Measuring voltage current and resistance
10	Investigate voltage and current relationship in series and parallel	Observing branch currents in Series and Parallel circuits	Measuring voltages and currents and drawing

	resistive circuits	Verifying current division in parallel circuits with calculated values	inferences
11	<p>Experimenting with transformer</p> <p>a) Identify the transformer type based on tapings</p> <p>i. Center tapped, ii. Multi tapped</p> <p>iii. Normal</p> <p>b) Test the given transformer using a multimeter, identify the windings.</p> <p>c) Find the Transformation ratio</p> <p>d) Demonstrate that transformer can step up or step down the voltage</p>	<p>a) Identify the transformer type based on its tapings</p> <p>i. Center tapped ii. Multi tapped, iii. Normal</p> <p>b) Test the given transformer using a multimeter identify the windings</p> <p>c) Find the Transformation ratio</p> <p>d) Demonstrate that transformer can step up or step down the voltage.</p>	<p>Identifying the type of transformer</p> <p>Testing the transformer</p>
12	<p>Identify different types of capacitors.</p> <p>a) Find the value/specifications of capacitor from Value printed ,and from Color code</p>	<p>Identify different types of capacitors by their name, Know the specifications and ratings.</p> <p>Find the value of capacitor from the colour code.</p>	
13	<p>Demonstrate that capacitor can hold charge ,charging and discharging require a specific time using an LED</p> <p>a) Investigate the effect of connecting capacitors in series and parallel</p> <p>b) Testing the capacitor Using multimeter, AC source (Transformer / Function generator) and headphones</p>	<p>Learn the behavior of capacitor by experimentation</p> <p>Connecting Capacitors in series and parallel and observing the effect on total capacitance.</p> <p>Testing the capacitor using multimeter and other methods</p>	<p>Understand the behavior of capacitors</p> <p>Testing the capacitors</p>
14	<p>Identifying different switches</p> <p>a) Identify different types of switches and their symbols</p> <p>b) Toggle switches, Rotary switches, Push button switches and DIP switches.</p> <p>c) Controlling a small Tape - recorder motor with a DPDT switch to run in Forward and reverse Directions.</p>	<p>Identifying different types of switches by observation, By name and symbol</p> <p>Using DPDT switch to reverse the Direction, Tape recorder motor</p> <p>Observing the constructional details and ratings of tape recorder motor</p>	<p>Identify the type of switch and its name</p> <p>Use DPDT switch</p>
15	<p>Testing the relay</p> <p>a) Use of NO and NC Contacts</p> <p>b) Using the relay to control a Lamp load.</p> <p>c) Using the double pole relay to control a fan motor.</p> <p>d) Making a simple relay motor control using double pole relay and push button switches</p>	<p>Know the constructional details of Relay</p> <p>Testing/identifying the coil connections with Multimeter</p> <p>Understand the purpose of Relay experimentally</p> <p>Use the relay in practical circuits.</p>	<p>Testing and using the relay</p>
16	. Soldering practice	Know the metals which can	Practicing soldering and

	a. Making wire tips b. joining wires c. joining components d. populating simple circuits like, Audio amplifier on a breadboard. e. testing the soldered connections using multimeter	be soldered Know the solder specifications Know the use of Flux in soldering, Practice the soldering,	disordering, Populating PCBs
17	Practice Desoldering using Desoldering Wick and Desoldering Pump	Practice desoldering using Desoldering wick and Desoldering Pump	
18	To draw the forward & reverse characteristics of Silicon diode a) determine Knee voltage, b) identify Cutoff, and Linear regions ii)a) Connect a 6V lamp in series with diode and test it on DC power supply b) Using the CRO & Curve tracer to observe the Characteristics. c) Heat the diode with a soldering Iron and observe the effect on reverse current	1. Identification of meters and equipment 2. Using DRB, DIB, DCB and measuring Voltage and current 3. Interpreting diode datasheets and finding the specifications of components used in the experiment	1. assembling the circuit as per the circuit diagram 2. Identification of Diode terminals by observation and also with DMM & Analogue Multimeter 3. Drawing inference and writing the report
19	a) To draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage b) Connect resistance ladder circuit (3 resistors) and measure the voltages at the output by varying input voltage while Zener is reverse biased	1. Identification of meters and equipment 2. Using DRB, DIB, DCB and measuring Voltage and current 3. Interpreting Zener diode datasheets and finding the specifications of components used in the experiment	1. Assembling the circuit as per the circuit diagram 2. Identification of Zener Diode terminals by observation and with DMM & Analogue Multimeter 3. Drawing inference and writing the report
20	To implement Rectifier circuits using Diodes and observe the effect of Filtering a) Implementing Half wave rectifier with and without filter b) Implementing Full wave rectifier with and without filter c) Implementing Bridge rectifier with and without filter d) Implementing Voltage Doubler circuit e) Connect a diode IN4007 in series with a 60W 230V Lamp and test it. (Record your observations)	1. Drawing the symbols of Transformer, Diode, Inductor and Capacitor 2. Reading the circuit diagram 3. Identification of Diode terminals 4. Identification of meters and equipment 5. Using DRB, DIB, DCB and measuring Voltage and current. 6. Observing the polarity of capacitors. 7. Interpreting diode datasheets and finding the specifications of components used in the experiment	1. Assembling the circuit as per the circuit diagram 2. Using the CRO, observe the waveforms 3. Assess the Power supply performance in terms of ripple and % Regulation 4. Drawing inference and writing the report
21	Familiarization of Transistor	1. Identify Transistor –different types. 2. Identify the leads 3. Drawing the symbols of Transistors 4. Finding the transistor type by using multimeter (PNP or NPN). 5. Identify the specifications through datasheets.	1. Identifying Transistor Terminals and Type 2. Reading Data sheets

		5. Know the package and differences between BC148A, 148B, 148C and BF194 from the data sheets.	
22	Transistor Characteristics in CB Configuration	<ol style="list-style-type: none"> 1. Identify Transistor and Test the Transistor terminals with multi meter 2. Connect the CB configuration circuit 3. observe emitter current I_E and emitter to base voltage V_{EB} by varying input bias 4. Draw the input characteristics-keeping V_{CB} constant for different values. 5. Calculate the dynamic resistance by graph = $\Delta V_{EB}/\Delta I_E$. 6. Note I_C by varying V_{CB} (should not cross max. 20V). 7 Draw the output characteristics-keeping I_E constant for different values. 8. Calculate the output dynamic resistance = $\Delta V_{cb}/\Delta I_C$ 9. Calculate $\alpha = I_C/I_E$. 10. Draw dc load line. 	<ol style="list-style-type: none"> 1. Draw the input and output characteristics of CB Configuration 2. Calculate the input and output dynamic resistance 3. Calculate $\alpha = I_C/I_E$.
23	Transistor Characteristics in CE Configuration	<ol style="list-style-type: none"> 1. Identify Transistor and Test the Transistor terminals with multimeter 2. Connect the CE configuration circuit 3. Observe base current I_B and base to emitter voltage V_{BE} by varying input bias 4. Draw the input characteristics-keeping V_{CE} constant for different values. 5. Find the dynamic resistance by graph $r_d = \Delta V_{BE}/\Delta I_B$. 6. Note I_C and V_{CE} by varying output bias (should not cross max. 20V). 7. Draw the output characteristics-keeping I_B constant for different values. 8. Calculate the output dynamic resistance = $\Delta V_{CE}/\Delta I_C$ 9. Calculate $\beta = I_C/I_B$. 10. Draw dc load line. 	<ol style="list-style-type: none"> 1. Draw the input and output characteristics of CE Configuration 2. Calculate the input and output dynamic resistance 3. Calculate $\beta = I_C/I_B$.
24	Turn on and turn off a relay using Transistor (BC148 as a switch.)	<ol style="list-style-type: none"> 1. Identification of Transistor terminals by observation 2. Test the Transistor terminals with multimeter and DMM. 3. Identifications of meters and equipment 4. Measure the collector and base currents when transistor in saturation and cutoff regions 5. Connect a 6v lamp in series with BD139 and observe the effect of base current variation on lamp brightness 	<ol style="list-style-type: none"> 1. Measure the Collector and Base currents when transistor in saturation and cutoff regions 2. Observe the switch action of transistor
25	Draw the input and output characteristics of JFET. b) Show that a FET can be used	<ol style="list-style-type: none"> 1. Drawing the symbols of FET, 2. Draw the circuit Diagram. 3. Identification of FET terminals 4. Identification of meters and equipment 5. Observe drain current I_D and source to drain voltage V_{DS} by varying bias 	<ol style="list-style-type: none"> 1. Assembling the circuit as per the circuit diagram 2. Identifying the ground, drain, gate and source terminals using

	as a constant current source with appropriate bias	3. Draw the drain characteristics by keeping V_{GS} constant for different values. (V_{DS}, I_d) 4. Measure pinch off voltage and transconductance.	multimeter (DMM and Analogue) also by physical observation 3. Observing the pinch off voltage accurately 4. Calculate trans conductance
26	To plot the characteristics of UJT and determine the intrinsic standoff ratio	1. Identify UJT and its package 2. Interpret specifications from datasheets 3. identify the terminals by observation and by multi meter 4. Observe base current I_B and base to emitter voltage V_{BE} by varying V_{BB} 5. draw the characteristics of UJT 6. Calculate intrinsic standoff ratio of UJT	1. Plot the characteristics and interpret the graph of UJT. 2. Determine intrinsic standoff ratio of UJT
27	To plot the characteristics of SCR	1. Identify SCR and its package 2. Identify the terminals by observation and by testing with Multimeter 4. observe diode current and voltage across SCR 5. Plot the characteristics of SCR for different gate triggering currents. 6. measure the break down voltages	1. Plot the characteristics and interpret the graph. 2. Determine Holding current and Triggering current. 3. measure the break down voltages
28	To plot the characteristics of LED	1. Identifying the device and terminals 2. Draw the symbols. 3. Connect the circuit. 4. Observe and note down the diode current and voltage across the diode by varying bias voltage 5. Measure the cut in voltage 6. Plot the characteristics of LED. 7. Repeat the above steps for different color LEDs	1. Draw the characteristics of LED 2. Measure the cut in voltage 3. Compare characteristics of LED's different colors.
29	To plot the characteristics of LDR	1. Identifying the device and terminals 2. Draw the symbols. 3. Connect the circuit. 4. Observe and note down the current and voltage across the LDR by varying the illumination of light 5. Plot the characteristics of LDR.	1. Draw the characteristics of LDR

PHYSICS LABORATORY

Subject Title	:	Physics Laboratory
Subject Code	:	Common -109
Periods per week	:	03
Total periods per year	:	45

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Hands on practice on Vernier Calipers	03
2.	Hands on practice on Screw gauge	03
3.	Verification of Parallelogram law of forces and Triangle law of forces	03
4.	Simple pendulum	03
5.	Velocity of sound in air – (Resonance method)	03
6.	Focal length and Focal power of convex lens (Separate & Combination)	03
7.	Refractive index of solid using traveling microscope	03
8.	Surface tension of liquid using traveling microscope	03
9.	Coefficient of viscosity by capillary method	03
10.	Boyle's law verification	03
11.	Meter bridge	03
12.	Mapping of magnet lines of force	03
	Revision	06
	Test	03
	Total:	45

Objectives:

Upon completion of the course the student shall be able to

- 1.0 Practise with Vernier calipers to determine the volumes and areas of a cylinder and sphere and their comparison etc .
- 2.0 Practise with Screw gauge to determine thickness of a glass plate, cross sectional area of a wire and volumes of sphere and also their comparison etc
- 3.0 Verify the parallelogram law and Triangle law
- 4.0 Determine the value of acceleration due to gravity using Simple Pendulum
- 5.0 Determine the velocity of sound in air at room temperature and its value at zero degree centigrade
- 6.0 Calculate the Focal length and focal power of convex lenses using distant object method , U-V method , U-V graph and $1/U - 1/V$ graph methods and their comparison,
- 7.0 Determine the refractive index of a solid using travelling microscope
- 8.0 Determine the surface tension of a liquid using travelling microscope
- 9.0 Determine the viscosity of a liquid using capillary method

- 10.0 Verify the Boyle's law employing a Quill tube
 11.0 Determine the specific resistance of material of a wire using Meter Bridge
 12.0 Drawing magnetic lines of force under N-S and N-N methods and locate null points

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	<ul style="list-style-type: none"> • Find the Least count • Fix the specimen in posit • Read the scales • Calculate the physical quantities of given object 	<ul style="list-style-type: none"> • Read the scales • Calculate the requisite physical quantities of given objects
2. Hands on practice on Screw gauge(03)	<ul style="list-style-type: none"> • Find the Least count • Fix the specimen in posit • Read the scales • Calculate thickness of glass place and cross section of wire and other quantities 	<ul style="list-style-type: none"> • Read the scales • Calculate thickness of given glass plate • Calculate cross section of wire and other quantities
3. Verification of Parallelogram law of forces and Triangle law of forces(03)	<ul style="list-style-type: none"> • Fix suitable weights • Note the positions of threads on drawing sheet • Find the angle at equilibrium point • Construct parallelogram • Compare the measured diagonal • Construct triangle • Find the length of sides • Compare the ratios 	<ul style="list-style-type: none"> • Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length
4. Simple pendulum(03)	<ul style="list-style-type: none"> • Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw I-T and I-T² graph 	<ul style="list-style-type: none"> • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw I-T and I-T² graph

Name of the Experiment(Periods)	Competencies	Key competencies
5. Velocity of sound in air –Resonance method (03)	<ul style="list-style-type: none"> • Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonating lengths • Calculate velocity of sound 	<ul style="list-style-type: none"> • Adjust the reservoir level • Find the first and second resonating lengths • Calculate velocity of sound at room temperature • Calculate velocity of sound at 0° C
6. Focal length and Focal power of convex lens (Separate & Combination) (03)	<ul style="list-style-type: none"> • Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses • Draw u-v and 1/u – 1/v graphs 	<ul style="list-style-type: none"> • Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs
7. Refractive index of solid using traveling microscope(03)	<ul style="list-style-type: none"> • Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab 	<ul style="list-style-type: none"> • Read the scale • Calculate the refractive index of glass slab
8. Surface tension of liquid using traveling microscope(03)	<ul style="list-style-type: none"> • Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water 	<ul style="list-style-type: none"> • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water

Name of the Experiment	Competencies	Key competencies
9. Coefficient of viscosity by capillary method(03)	<ul style="list-style-type: none"> • Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method 	<ul style="list-style-type: none"> • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water
10. Boyle's law verification (03)	<ul style="list-style-type: none"> • Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value $P \times l$ 	<ul style="list-style-type: none"> • Find the length of air column • Find the pressure of enclosed air • Find the value $P \times l$
11. Meter bridge(03)	<ul style="list-style-type: none"> • Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance 	<ul style="list-style-type: none"> • Find the balancing length • Calculate unknown resistance • Calculate the specific resistance
12. Mapping of magnet lines of force(03)	<ul style="list-style-type: none"> • Draw magnetic meridian • Placed the bar magnet in NN and NS directions • Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines 	<ul style="list-style-type: none"> • Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines

CHEMISTRY LABORATORY

Subject Title : **Chemistry Laboratory**
Subject Code : **Common -110**
Periods per week : **03**
Total periods per year : **45**

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Familiarization of methods for Volumetric analysis	03
2.	Preparation of Std Na_2CO_3 and making solutions of different dilution	03
3.	Estimation of HCl solution using Std. Na_2CO_3 solution	03
4.	Estimation of NaOH using Std. HCl solution	03
5.	Estimation of H_2SO_4 using Std. NaOH solution	03
6.	Estimation of Mohr's Salt using Std. KMnO_4	03
7.	Determination of acidity of water sample	03
8.	Determination of alkalinity of water sample	03
9.	Determination of total hardness of water using Std. EDTA solution	03
10.	Estimation of Chlorides present in water sample	03
11.	Estimation of Dissolved Oxygen (D.O) in water sample	03
12.	Determination of pH using pH meter	03
13.	Determination of conductivity of water and adjusting ionic strength	03
14.	Determination of turbidity of water	03
15.	Estimation of total solids present in water sample	03
	Total:	45

Objectives:

Upon completion of the course the student shall be able to

- 1.0 Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc.
- 2.0 Practice making standard solutions with pre weighed salts and to make solutions of desired dilutions using appropriate techniques.
- 3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3 solution for estimation of HCl
- 4.0 Conduct titrations adopting standard procedures and using Std. HCl solution for estimation of NaOH
- 5.0 Conduct titrations adopting standard procedures and using Std. NaOH solution for estimation of H_2SO_4
- 6.0 Conduct titrations adopting standard procedures and using Std. KMnO_4 solution for

- estimation of Mohr's Salt
- 7.0 Conduct titrations adopting standard procedures to determine the acidity of given samples of water (One ground water and one surface / tap water, and rain water if available)
 - 8.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (One ground water and one surface / tap water)
 - 9.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water (One ground water and one surface / tap water) using Std. EDTA solution
 - 10.0 Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water and wastewater (One ground water and one surface / tap water)
 - 11.0 Conduct the test using titrometric / electrometric method to determine Dissolved Oxygen (D.O) in given water samples (One sample from closed container and one from open container / tap water)
 - 12.0 Conduct the test on given samples of water / solutions (like soft drinks, sewage, etc.) to determine their pH using standard pH meter
 - 13.0 Conduct the test on given samples of water / solutions
 - a) To determine conductivity
 - b) To adjust the ionic strength of the sample to the desired value
 - 14.0 Conduct the test on given samples of solutions (coloured and non coloured) to determine their turbidity in NTU
 - 15.0 Conduct titrations adopting standard procedures to determine the total solids present in given samples of water (One ground water and one surface / tap water)

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis (03)	--	--
Preparation of Std Na_2CO_3 and making solutions of different dilution (03)	<ul style="list-style-type: none"> ▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions 	<ul style="list-style-type: none"> ▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions

Name of the Experiment (No of Periods)	Competencies	Key competencies
Estimation of HCl solution using Std. Na_2CO_3 solution (03)	<ul style="list-style-type: none"> ▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results 	<ul style="list-style-type: none"> ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations
Estimation of NaOH using Std. HCl solution (03)		
Estimation of H_2SO_4 using Std. NaOH solution (03)		
Estimation of Mohr's Salt using Std. KMnO_4 (03)		
Determination of acidity of water sample (03)		
Determination of alkalinity of water sample (03)		
Determination of total hardness of water using Std. EDTA solution (03)		
Estimation of Chlorides present in water sample (03)		
Estimation of Dissolved Oxygen (D.O) in water sample (By titration method) (03)		
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method) (03)	<ul style="list-style-type: none"> ▪ Familiarize with instrument ▪ Choose appropriate 'Mode' / 'Unit' ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately ▪ Follow Safety precautions 	<ul style="list-style-type: none"> ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately
Determination of pH using pH meter (03)		
Determination of conductivity of water and adjusting ionic strength to required level (03)		
Determination of turbidity of water (03)		
Name of the Experiment (No of Periods)	Competencies	Key competencies

<p>Estimation of total solids present in water sample (03)</p>	<ul style="list-style-type: none"> ▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate ▪ Drying the crucible in an oven 	<ul style="list-style-type: none"> ▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate
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COMPUTER FUNDAMENTALS LABORATORY

(Common to all Branches)

Subject Title : Computer Fundamentals Laboratory
Subject Code : BM-111
Periods/Week : 03
Periods/Year : 90

Time Schedule

S. No.	Major Topics	No. of sessions each of 3 periods duration	No. of Periods
I.	Computer hardware Basics	02	06
II.	Windows Operating System	02	06
III.	MS Word	08	24
IV.	MS Excel	09	27
V.	MS PowerPoint	09	27
Total		30	90

Rationale: The knowledge of Computer usage has become a must for everyone, due to wide spread computer usage and related applications in all fields. This laboratory is designed to give the students hands on practice of Windows Operating System and MS Office to enable the students to use these skills in future courses.

I. Computer Hardware Basics (Not for end examination)

1. a) To familiarize with a Computer System and its hardware connections.
b) To start and Shutdown a Computer correctly.
c) To check the software details of the computer
d) To practice Internal and External DOS commands
2. To check the hardware present in your computer.

II. Windows's operating system (Not for end examination)

3. To explore Windows Desktop
4. Working with Files and Folders
5. Windows Accessories: Calculator – Notepad – WordPad – MS Paint

III. Practice with MS-WORD

6. To familiarize with Ribbon layout of MS Word
Home - Insert - Page layout – References – Review - View
7. To practice Word Processing Basics
8. To practice Formatting techniques
9. To insert a table of required number of rows and columns

10. To insert Objects, Clipart and Hyperlinks
11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

IV. Practice with MS-EXCEL

13. To familiarize with MS-EXCEL layout
14. To access and Enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To practice Excel Graphs and Charts
20. To format a Worksheet in Excel, Page Setup and Print

V. Practice with MS-POWERPOINT

21. To familiarize with Ribbon layout features of PowerPoint 2007.
22. To create a simple PowerPoint Presentation
23. To set up a Master Slide in PowerPoint
24. To insert Text and Objects
25. To insert a Flow Charts
26. To insert a Table
27. To insert a Charts/Graphs
28. To insert video and audio
29. To practice Animating text and objects
30. To Review presentation

Competencies and Key Competencies to be achieved by the students

Exp No.	Name of the Experiment	Competencies	Key Competencies
1 (a).	To familiarize with Computer system and hardware connections	<ul style="list-style-type: none"> a. Identify the Parts of a Computer system a). CPU b) Monitor c) CD/DVD Drive d) Power Switch e) Start Button f) Reset Button b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU and connect Keyboard & Mouse 	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	<ul style="list-style-type: none"> a. Log in using the password b. Start and shut down the computer c. Use Mouse and Keyboard 	<ul style="list-style-type: none"> a. Login and logout as per the standard procedure b. Operate mouse & Keyboard
1 (c).	To explore Windows Desktop	<ul style="list-style-type: none"> a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support 	<ul style="list-style-type: none"> a. Access application programs using Start menu b. Use taskbar and Task manager
1(d).	To practice Internal and External DOS commands	<ul style="list-style-type: none"> a. Practice Internal commands b. Practice External commands 	Familiarize with MS-DOS Commands
2.	To check the software details of the computer	<ul style="list-style-type: none"> c. Find the details of Operating System being used d. Find the details of Service Pack installed 	Access the properties of computer and find the details
3.	To check the hardware present in your computer	<ul style="list-style-type: none"> a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard Disk Drives and partitions e. Use the Taskbar 	<ul style="list-style-type: none"> a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	<ul style="list-style-type: none"> a. Create folders and organizing files in different folders b. Use copy / paste or move commands to organize files and folders 	a. Create files and folders rename , arrange and search for the required folder/file

Exp No.	Name of the Experiment	Competencies	Key Competencies
	Working with Files and Folders Continued....	<ul style="list-style-type: none"> c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut for files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin 	<ul style="list-style-type: none"> b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	<ul style="list-style-type: none"> a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint 	<ul style="list-style-type: none"> a. Use windows accessories and select correct text editor based on the situation. b. Use MS Paint to create /Edit pictures and save in the required format.
6.	To familiarize with Ribbon layout of MS Word. – Home – Insert- Page Layout- References- Review-View	<ul style="list-style-type: none"> a. Create/Open a document b. Use Save and Save as features c. Work on two documents simultaneously d. Choose correct Paper size and Printing options 	<ul style="list-style-type: none"> a. Create a Document and name appropriately and save b. Set paper size and print options
7.	To practice Word Processing Basics	<ul style="list-style-type: none"> a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS- word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar 	<ul style="list-style-type: none"> a. Use keyboard and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	<ul style="list-style-type: none"> a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer 	<ul style="list-style-type: none"> a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers

Exp No.	Name of the Experiment	Competencies	Key Competencies
9.	To insert a table of required number of rows and columns	<ul style="list-style-type: none"> a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table – marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order 	<ul style="list-style-type: none"> a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	<ul style="list-style-type: none"> a. Create a 2-page document. &Insert hyperlinks and Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table. 	<ul style="list-style-type: none"> a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	<ul style="list-style-type: none"> a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes. 	Use Mail merge feature
12.	To use Equations and symbols features.	<ul style="list-style-type: none"> a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document 	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	<ul style="list-style-type: none"> a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar- Title Bar- Ribbon-Worksheets- Formula Bar-Status Bar 	<ul style="list-style-type: none"> a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	<ul style="list-style-type: none"> a. Move around a Worksheet- Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel 	<ul style="list-style-type: none"> a. Access and select the required cells by various addressing methods b. Enter data and edit

Exp No.	Name of the Experiment	Competencies	Key Competencies
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15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	<ul style="list-style-type: none"> a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width 	Format the excel sheet
16.	To use built in functions and Formatting Data	<ul style="list-style-type: none"> a. Sort and filter data in a worksheet b. Perform Mathematical Calculations verify -AutoSum c. Perform Automatic Calculations-Align Cell Entries 	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	<ul style="list-style-type: none"> a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help 	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	<ul style="list-style-type: none"> a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically 	<ul style="list-style-type: none"> a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To Practice Excel Graphs and Charts	<ul style="list-style-type: none"> a. Produce an Excel Pie Chart b. Produce an Excel Column Chart c. Practice creating any Chart 	<ul style="list-style-type: none"> a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
20.	To format a Worksheet in Excel, page setup and print	<ul style="list-style-type: none"> a. Shade alternate rows of data b. Add currency and percent symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print 	<ul style="list-style-type: none"> a. Format Excel sheet b. Insert headers & footers and print
21.	To familiarize with Ribbon layout & features of PowerPoint 2007.	Use various options in Home, insert, design, animation , slideshow, Review & View in the PowerPoint	Access required options in the tool bar

Exp No.	Name of the Experiment	Competencies	Key Competencies
22.	To create a simple PowerPoint Presentation	<ul style="list-style-type: none"> a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a PowerPoint slide 	<ul style="list-style-type: none"> a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes b. Use bullets option
23.	To Set up a Master Slide in PowerPoint and add notes	<ul style="list-style-type: none"> a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint f. Add Notes to a PowerPoint Presentation 	<ul style="list-style-type: none"> a. Setup Masterslide and format b. Add notes
24.	To Insert Text and Objects	<ul style="list-style-type: none"> a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and WordArt f. Use 3d features g. Arrange objects 	<ul style="list-style-type: none"> Inset Text and Objects Use 3d features
25.	To insert a Flow Chart / Organizational Charts	<ul style="list-style-type: none"> a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art 	<ul style="list-style-type: none"> Create organizational charts and flow charts using smart art
26.	To insert a Table	<ul style="list-style-type: none"> a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend 	<ul style="list-style-type: none"> Insert tables and format
27.	To insert a Charts/Graphs	<ul style="list-style-type: none"> a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart e. Format a Chart Background 	<ul style="list-style-type: none"> Create charts and Bar graphs, Pie Charts and format.

Exp No.	Name of the Experiment	Competencies	Key Competencies
28.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	<ul style="list-style-type: none"> a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks 	<ul style="list-style-type: none"> a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
29.	To Practice Animation effects	<ul style="list-style-type: none"> a. Apply transitions to slides b. To explore and practice special animation effects like <i>Entrance, Emphasis, Motion Paths & Exit</i> 	Add animation effects
30.	Reviewing presentation	<ul style="list-style-type: none"> a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation <ul style="list-style-type: none"> (a) Slides (b) Handout 	<ul style="list-style-type: none"> a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

III SEMESTER

**3 & ½ YEARS DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
THIRD SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination			
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks
BM-301	Engineering Mathematics- II	6	--	90	3	20	80	100
BM-302	Electronic Circuits	6	--	90	3	20	80	100
BM-303	Network Analysis	6	--	90	3	20	80	100
BM-304	Digital Electronics	6	--	90	3	20	80	100
BM-305	Programming In 'C'	6	--	90	3	20	80	100
BM-306	Communication Skills Lab Practice	--	3	45	3	40	60	100
BM-307	Electronic Circuits & Network Analysis Lab Practice	--	3	45	3	40	60	100
BM-308	Digital Electronics Lab Practice	--	3	45	3	40	60	100
BM-309	Programming In 'C' & MATLAB Practice	--	3	45	3	40	60	100
		30	12	630		260	640	900

ENGINEERING MATHEMATICS – II

Subject Title : Engineering Mathematics-II

Subject Code : BM-301

Periods per week : 06

Periods per Semester : 90

Blue print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type			
				R	U	App	R	U	App	
	Unit - I									
1	Indefinite Integration	15	21	1	1	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	
	Unit - II									
2	Definite Integration and its applications	30	44	1	1	1	1	1	$1\frac{1}{2}$	
	Unit - III									
3	Integral Transforms	20	16	0	1	1	0	$\frac{1}{2}$	$\frac{1}{2}$	
	Unit - IV									
4	Differential Equations	25	29	2	1	0	1	1	0	
	Total	90	110	4	4	2	$2\frac{1}{2}$	3	$2\frac{1}{2}$	
				Marks:	12	12	6	25	30	25

R: Remembering type 37 marks

Understanding

U: type 42 marks

App: Application type 31 marks

OBJECTIVES

Upon completion of the subject the student shall be able to

Unit-I

1.0 Indefinite Integration

- 1.1 Explain the concept of Indefinite integral as an anti-derivative.
- 1.2 State the indefinite integral of standard functions and properties of Integrals $\int (u + v) dx$ and $\int ku dx$ where k is constant and u, v are functions of x .
- 1.3 Solve integration problems involving standard functions using the above rules.
- 1.4 Evaluate integrals involving simple functions of the following type by the method of substitution.
 - i) $\int f(ax + b) dx$ where $f(x) dx$ is in standard form.
 - ii) $\int [f(x)]^n f'(x) dx$
 - iii) $\int f'(x)/[f(x)] dx$
 - iv) $\int f\{g(x)\} g'(x) dx$
- 1.5 Find the Integrals of $\tan x, \cot x, \sec x$ and $\operatorname{cosec} x$ using the above.
- 1.6 Evaluate the integrals of the form $\int \sin^m \theta \cos^n \theta. d\theta$ where m and n are positive integers.
- 1.7 Evaluate integrals of powers of $\tan x$ and $\sec x$.
- 1.8 Evaluate the Standard Integrals of the functions of the type

$$i) \frac{1}{a^2 + x^2}, \frac{1}{a^2 - x^2}, \frac{1}{x^2 - a^2}$$

$$ii) \frac{1}{\sqrt{a^2 + x^2}}, \frac{1}{\sqrt{a^2 - x^2}}, \frac{1}{\sqrt{x^2 - a^2}}$$

$$iii) \sqrt{x^2 - a^2}, \sqrt{x^2 + a^2}, \sqrt{a^2 - x^2}$$

- 1.9 Evaluate the integrals of the type

$$\int \frac{1}{a \pm b \sin \theta} d\theta, \int \frac{1}{a \pm b \cos \theta} d\theta \text{ and } \int \frac{1}{a \cos \theta \pm b \sin \theta \pm c} d\theta .$$

- 1.10 Evaluate integrals using decomposition method.
- 1.11 Evaluate integrals using integration by parts with examples.
- 1.12 State the Bernoulli's rule for evaluating the integrals of the form $\int u.v dx$.

- 1.13 Evaluate the integrals of the form $\int e^x [f(x) + f'(x)] dx$.

Unit-II

(a) Understand definite integral and its properties

- 2.1 State the fundamental theorem of integral calculus
- 2.2 Explain the concept of definite integral.
- 2.3 Calculate the definite integral over an interval.
- 2.4 State various properties of definite integrals.
- 2.5 Evaluate simple problems on definite integrals using the above properties.

(b) Real life applications of definite integrals

- 2.6 Explain definite integral as a limit of sum by considering an area.
- 2.7 Find the areas under plane curves and area enclosed between two curves using integration.
- 2.8 Obtain the volumes of solids of revolution.
- 2.9 Obtain the mean value and root mean square value of the functions in any given interval.
- 2.10 Explain the Trapezoidal rule, Simpson's 1/3 rules for approximation of integrals and provide some examples.

(c) Understand the Fourier series expansion of functions

- 2.11 Define Fourier series of a function on the interval $(c, c + 2l)$ and state sufficient conditions for its existence. Write the Euler's formulae for determining the Fourier coefficients.
- 2.12 Find Fourier series of simple functions in the range $(0, 2l)$, $(0, 2\pi)$, $(-l, l)$ and $(-\pi, \pi)$.
- 2.13 Find Fourier coefficients for even and odd functions in the interval $(-l, l)$ and $(-\pi, \pi)$ in simple examples.
- 2.14 Define half range Fourier sine and cosine series of a function over the interval $(0, l)$ with examples

3.0 Integral Transforms

(a) Laplace Transforms

- 3.1 Write the definition of Laplace Transform and explain sufficient conditions for its existence.
- 3.2 Provide formulae for Laplace transforms of standard functions.
- 3.3 State Linear property, First shifting property, Change of Scale property for Laplace transforms. Solve simple problems using these properties.
- 3.4 Write formulae for Laplace transform of $t^n f(t)$, $\frac{f(t)}{t}$, $f^{(n)}(t)$, $\int_0^t f(u) du$ in terms of Laplace transform of $f(t)$. Provide simple examples on these functions.
- 3.5 Define unit step function and write the Laplace Transform of unit step function.
State second shifting property.
- 3.6 Define inverse Laplace Transform and write inverse Laplace Transform of standard functions. Solve simple problems.
- 3.7 Write first shifting property of inverse Laplace Transform with examples
- 3.8 Define convolution of two functions and state convolution theorem with few examples for understanding only.

(b) Fourier Transforms

- 3.9 Define Infinite Fourier Transform of the function- give existence condition
- 3.10 Define Fourier Sine and Cosine Transforms of a function
- 3.11 State the relation between Fourier and Laplace Transform
- 3.12 Mention the properties (Linear, Change of Scale and Shifting Properties) of Fourier Transforms.
- 3.13 Find the Fourier transforms of simple functions viz., $k, x, x^2, \sin ax, \cos ax, e^{ax}$ and unit step functions
- 3.14 State Convolution theorem with examples for understanding.
- 3.15 List applications of Fourier transforms in Engineering.

(a) Z- Transforms

3.16 Define the Terms Sequence and Series, provide examples

3.17 Define Z-Transform of a sequence and provide Z-Transform of

$$1, k, (-1)^n, n^p (p \in N), \frac{1}{n!}, \sin nx, \cos nx \text{ and } e^{nx}.$$

3.18 State Linear property, shifting property, Change of Scale property and multiplication by n for Z- Transforms Solve simple problems using these properties.

3.19 State Convolution theorem with examples for understanding

3.20 List applications of Z- transforms in Engineering.

4.0 Introduction to Differential Equations

4.1 Define a Differential equation, its order, degree

4.2 Form a differential equation by eliminating arbitrary constants.

4.3 Solve the first order first degree differential equations by the following methods:

- i. Variables Separable.
- ii. Homogeneous Equations.
- iii. Exact Differential Equations
- iv. Linear differential equation of the form $dy/dx + Py = Q$, where P and Q are functions of x or constants.
- iv. Bernoulli's Equation (Reducible to linear form.)

4.4 Solve Differential equations of the type $(aD^2 + bD + c)y = 0$ when the roots of the auxiliary equation are real and different, real and repeated, Complex conjugates.

4.5 Solve the higher order homogeneous differential equations with constant coefficients.

4.6 Explain the concept of complementary function, particular Integral and general solution of a differential equation.

4.7 Solve n^{th} order differential equation of the type $f(D) y = X$ where $f(D)$ is a polynomial of nth order and X is a function of the form $k, e^{ax}, \sin ax, \cos ax, x^n$.

4.8 Solve simple problems leading to engineering applications

COURSE CONTENT

Unit-I

Indefinite Integration:

1. Integration regarded as anti-derivative – Indefinite integral of standard functions. Properties of indefinite integral. Integration by substitution or change of variable. Integrals of the form $\int \sin^m \theta \cos^n \theta$. where m and n are positive integers. Integrals of $\tan x$, $\cot x$, $\sec x$, $\operatorname{cosec} x$ and powers of $\tan x$, $\sec x$ by substitution.

Evaluation of integrals which are reducible to the following forms :

$$\begin{aligned} i) & \frac{1}{a^2 + x^2}, \frac{1}{a^2 - x^2}, \frac{1}{x^2 - a^2} \\ ii) & \frac{1}{\sqrt{a^2 + x^2}}, \frac{1}{\sqrt{a^2 - x^2}}, \frac{1}{\sqrt{x^2 - a^2}} \\ iii) & \sqrt{x^2 - a^2}, \sqrt{x^2 + a^2}, \sqrt{a^2 - x^2} \end{aligned}$$

Integration by decomposition of the integrand into simple rational, algebraic functions. Integration by parts, Bernoulli's rule.

Unit-II

Definite Integral and its applications:

2. Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Definite integral as the limit of a sum. Area under plane curves – Area enclosed between two curves. Volumes of solids of revolution. Mean and RMS values of a function on a given interval. Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a definite integral.

Representation of a function in Fourier series over the interval $(c, c + 2l)$, Give sufficient conditions for existence of Fourier series. Euler's formulae for Fourier

coefficients, Finding Fourier coefficients for simple functions, elementary even and odd functions. Define half range Fourier series.

Unit-III

Integral Transforms

Definition, sufficient conditions for existence of Laplace Transform (LT), LT of elementary functions, linearity property, scale change property, first shifting property, multiplication by t^n , division by t , LT of derivatives and integrals, unit step function, LT of unit step function, second shifting theorem, inverse Laplace transforms- shifting theorems and change of scale property, multiplication by s^n and division by s – examples of inverse LT using partial fractions – convolution theorem (no proof).

Define Infinite Fourier Transform of the function- give existence condition Define Fourier Sine and Cosine Transforms of a function - State the relation between Fourier and Laplace Transform - Mention Linear, Change of Scale and Shifting Properties of Fourier Transforms. -Find the Fourier transforms of simple functions viz., $k, x, x^2, \sin ax, \cos ax, e^{ax}$ and unit step functions - State Convolution theorem with examples for understanding.- Mention applications of Fourier transforms in Engineering.

Define the Terms Sequence and Series, provide examples - Define Z-Transform of a sequence and provide Z-Transforms of $1, k, (-1)^n, n^p (p \in \mathbb{N}, 1n!, \sin nx, \cos nx \text{ and } enx$ - State Linear property, shifting property, Change of Scale property and multiplication by n for Z- Transforms Solve simple problems using these properties -State Convolution theorem with examples for understanding-List applications of Z- transforms in Engineering.

Unit -IV

Differential Equations:

Definition of a differential equation-order and degree of a differential equation-formation of differential equations-solution of differential equation of first order, first degree: variable-separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.

Non-homogenous linear differential equations with constant coefficients of the form $f(D)y = X$, where X is in the form k , e^{ax} , $\sin ax$, $\cos ax$, x^n , ($n= 1,2$) – complimentary function, particular integral and general solution.

Reference Books:

1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan
2. Thomas' Calculus, Pearson Addison –Wesley Publishers
3. A Text book of Engg. Mathematics by B.S.Grawel
4. A Text book of Engg. Mathematics by B.V.Ramana- T.Mc Graw Hill Publishers

ELECTRONIC CIRCUITS

Subject Title : **Electronic Circuits**
Subject Code : **BM – 302**
Periods per Week : **06**
Periods per Semester : **90**

TIME SCHEDULE

S.N o.	Major Topics	Periods	Weightage of Marks	Short Type	Essay Type
1.	Amplifiers	18	21	2	1.5
2.	Small signal Amplifiers	20	26	2	2
3.	A.F. power Amplifiers	16	21	2	1.5
4.	RF tuned Amplifiers	20	26	2	2
5.	Feedback Amplifiers	16	16	2	1
	TOTAL	90	110	10	8

OBJECTIVES

1.0 Explain the operation of Transistor Amplifier.

- 1.1 Explain the purpose of an amplifier
- 1.2 Classify the amplifier on the basis of active device used, configuration, frequency range, function of the circuit(voltage & power), types of coupling, types of load, period of conduction.
- 1.3 Explain the basis of amplification by a transistor using load line concept.
- 1.4 Explain the equivalent circuit analysis and mention its use.
- 1.5 Sketch the h-parameter model for transistor in CE, CB, CC configuration. Mention the conversion formulae for CB, CE, CC. give the typical h-parameter value for the three configuration
- 1.6 Derive the expressions for voltage gain, current gain, I/p Z and o/p Z for CE, CB and CC configuration.

- 1.7 Sketch the approximate h-parameter CE, CB & CC configuration.
- 1.8 Derive approximate expression for voltage gain, current gain, i/p Z and o/p Z .
- 1.9 Solve some simple problems.
- 1.10 Sketch the hybrid pi-model for transistor at high frequencies.
- 1.11 Define alpha cut off frequency and Beta cut off frequency.

2.0 Comprehend the transistor amplifier using FET and BJT.

- 2.1 Sketch the circuit of single stage RC coupled amplifier in CE mode with potential Divider type of biasing.
- 2.2 Indicate the purpose of each component in the above circuits.
- 2.3 Sketch the approximate AC equivalent circuit of RC coupled amplifier at LF, MF & HF.
- 2.4 Derive the approximate voltage gain.
- 2.5 Sketch the frequency response curve for an RC coupled amplifier and give reasons for the shape of the response.
- 2.6 Define Band Width, upper cut off frequency and lower cut off frequency.
- 2.7 List the factors which affect the band width of a transistor amplifier.
- 2.8 Illustrate that the gain Band width product is constant.
- 2.9 Explain the working of CB amplifier circuit with input and output wave forms. Give the middle frequency equivalent circuit
- 2.10 Explain the working of CC amplifier circuit with input and output waveforms Give mid frequency equivalent circuit. Derive expressions for A_v , A_i , Z_i , Z_o .
- 2.11 Sketch the FET common source amp circuit with self bias.
- 2.12 Indicate approximate AC equivalent circuit.
- 2.13 Explain the operation of above circuit with input and output wave shapes.
- 2.14 Explain the working of CG, CD amp circuit with input and output wave forms.
- 2.15 Sketch and explain two stage RC coupled amplifier using BJT & FET

- 2.16 Derive the voltage gain for the above circuit.
- 2.17 Express the voltage gain in db value
- 2.18 Calculate the voltage gain in db given input and output voltages of an amplifier.
- 2.19 Express the need of Direct coupled amplifier and explain with circuit diagram
- 2.20 Express the advantages and disadvantages of D.C. amplifiers.
- 2.21 Sketch the explain Darlington pair configuration.
- 2.22 Explain the advantages of Darlington configuration

3.0 Understand the working of AF amplifiers.

- 3.1 Distinguish between voltage amplifier and power amplifier.
- 3.2 Classify different power amplifiers using transistors.
- 3.3 sketch the circuit of class- A single ended transistor power amplifier.
- 3.4 Explain the working of above amplifier with graphical analysis
- 3.5 Explain the need for output transformer in the above circuit.
- 3.6 Derive the expression for output power and efficiency of the above power amplifier.
- 3.7 sketch and explain the phase splitter circuit.
- 3.8 Discuss the input drive requirements of push-pull amplifier.
- 3.9 Sketch and explain the class B push pull amplifier
- 3.10 Derive the expression for efficiency and list the advantage and disadvantages of push-pull amplifiers.
- 3.11 Illustrate that even harmonics are eliminated in class B push-pull amplifier
- 3.12 Discuss the need of class-AB push-pull operation.
- 3.13 Sketch the circuits of a complementary push-pull power amplifier and explain its working.
- 3.14 Discuss the advantages of complementary power amplifier.
- 3.15 List the applications of power amplifier.
- 3.16 List different IC numbers for power amplifiers.

- 3.17 Discuss the necessity of Heat sink for a power transistor and power I.C. device.
- 3.18 List the different types of heat sinks and mounting methods.

4.0 Describe the function and performance of RF tuned voltage and power amplifier.

- 4.1 Explain the limitations of transistor at RF.
- 4.2 Classify the RF voltage amplifier on the basis of type of load.
- 4.3 Sketch the circuit of single tuned and double tuned RF voltage amplifier.
- 4.4 Sketch the frequency response of the above amplifiers.
- 4.5 Express the Bandwidth in terms of resonant frequency and the quality factor of tuned circuit.
- 4.6 Identify the important features of stagger tuned amplifiers by sketching its frequency response.
- 4.7 Compare the merits and demerits of single tuned , double tuned and stagger tuned amp's on the basis of Band width, gain tuning facility and applications.
- 4.8 Explain the need of neutralizing capacitor in the RF tuned voltage amplifier.
- 4.9 Explain the function of RF tuned power amplifier.
- 4.10 Explain the reason for selecting class C operation in the RF tuned power amplifier.
- 4.11 Sketch the basic circuit of class C power amplifier (using transistor)
- 4.12 Sketch the wave forms of input signal, collector current and output signal of above amplifier.
- 4.13 Indicate the expression for the tank circuit efficiency of tuned RF power amplifier.
- 4.14 Discuss the performance of class C tuned power amplifier,
- 4.15 Sketch and explain the neutralization circuits of coil, Hazeltined, rice and cross neutralization methods.
- 4.16 Sketch the circuit of harmonic generator.

- 4.17 Explain the working of the above circuit.
- 4.18 Distinguish between class C and Harmonic generator.
- 4.19 List the applications of class C amplifier and harmonic generator

5.0 Understand the Principles of Feedback in Amplifiers

- 5.1 Explain the basic concept of feedback in amplifiers
- 5.2 Explain the difference between positive feedback and negative feedback and list advantages and disadvantages
- 5.3 Define feedback factor Beta (β)
- 5.4 Derive the voltage gain of the negative feedback amplifiers in terms of gain of the same amplifier without feedback
- 5.5 Classify Different negative feedback amplifiers and draw their block diagrams
- 5.6 Illustrate the advantages of negative feedback amplifiers with specific reference to non-linear distortion, noise stability and bandwidth.
- 5.7 Sketch the transistor circuits with voltage feedback and current feedback
- 5.8 Discuss the effect of negative feedback on the input impedance and output impedance of the different negative feedback amplifier circuits

COURSE CONTENTS

1. AMPLIFIERS

Transistor as an amplifier, classification of amplifier, Analysis of a transistor amplifier ckt using h-parameters. Approximate hybrid model for CC, CE, CB configurations at low frequencies. Hybrid pi model of transistor at high frequencies.

2. SMALL SIGNAL AMPLIFIERS

Working of single stage BJT and FET amplifier at low frequencies and at high frequencies, working of common base, common collector and Darlington configuration, common source and source follower at low & high frequencies, RC coupled amp (BJT, FET), Direct coupled amplifier.

3. AF POWER AMPLIFIER

Class A single ended, push pull amplifier (Class B), conditions for max power output, phase inverter, complementary symmetry amplifier

4. RF TUNED VOLTAGE AND POWER AMPLIFIER

Single tuned, double tuned and stagger tuned amplifiers, applications - Tuned class C amplifier, Tank circuit efficiency, neutralization circuits, harmonic generator.

5 FEED BACK AMPLIFIERS:

Basic concepts in feed back, voltage and current feedback effects of feed back, stabilization of gain, reduction of non linear distortion, decrease in noise, gain, bandwidth product compromise.

TEXT BOOKS

1. Electronic device and circuits – Millman & Halkias.
- 2.. Basic Electronics and liner circuits by N. Bhargava, Kulshresta, S.C. Gupta

REFERENCE BOOKS

- 1 Transistor circuit analysis – Ben zenes.
2. Principle of Electronics - Malvino
3. Electronic Fundamentals - David Bell

NETWORK ANALYSIS

Subject	:	Network Analysis
Subject Code	:	BM-303
Periods per Week	:	06
Periods per Semester	:	90

TIME SCHEDULE

Sl.No	Major topics	Periods	Weightage of Marks	Short Type	Essay Type
1.	Resonance	18	21	2	1.5
2.	Network analysis & Theorems	24	29	3	2
3.	Coupled Circuits	12	13	1	1
4.	Networks	24	29	3	2
5	Transmission Line	12	18	1	1.5
	TOTAL	90	110	10	8

OBJECTIVES

1.0 Understand the resonance in A.C. Circuits.

- 1.1 Define resonance in RLC A.C. Circuits.
- 1.2 Derive the expression for resonant frequency, impedance and current at resonance of RLC series circuits.
- 1.3 Explain series resonance with the help of reactance curves.
- 1.4 Determine the bandwidth from the frequency response characteristic.
- 1.5 Explain how the series resonance acts as a voltage magnifying circuit.
- 1.6 Explain the effect of resistance on selectivity and Band Width.
- 1.7 Define the quality factor of coils, capacitor and circuits.
- 1.8 Calculate 'Q' from Band Width and resonant frequency.
- 1.9 Derive an expression for impedance of parallel circuit at anti-resonant frequency.

- 1.10 Derive an expression for anti-resonance frequency.
- 1.11 Explain anti – resonance-using susceptance curves.
- 1.12 Explain how the anti – resonant circuit act as a current magnifier / rejecter circuit.
- 1.13 List the application of resonant circuit.
- 1.14 Solve simple problems on series and parallel resonance circuits.
- 1.15 Compare the performance characteristics of series and parallel resonance circuits.

2.0 Analyze the networks by network analysis methods and network theorems

- 2.1 Explain ideal voltage source and ideal current source
- 2.2 List the two methods of network analysis based on Kirchhoff's laws.
- 2.3 Explain the method of selecting mesh currents.
- 2.4 Find the number of mesh currents required.
- 2.5 Obtain / write the mesh current equations for the given circuit.
- 2.6 Analyze the networks by applying mesh current equations
- 2.7 Solve mesh current equations using Cramer's rule
- 2.8 Define the driving point impedance and transfer impedance of a network
- 2.9 Select the principal nodes in node voltage network.
- 2.10 Obtain node voltage equations for a given network.
- 2.11 Analyze the networks by applying node voltage equations
- 2.12 Define driving point, transfer admittances of a network.
- 2.13 Explain the principle of Duality
- 2.14 Sketch the dual of a given network.
- 2.15 Define Thevenin's, Norton's, Super position and maximum power transfer Theorems, Millman's theorem.
- 2.16 Apply the above theorems in solving problems.

3.0 Analyze the coupled circuits.

- 3.1 Give the types of inductively coupled circuits

- 3.2 Explain dot rules for coupled circuits
- 3.3 Apply dot rules for analysis of coupled circuits
- 3.4 Explain the phenomenon of reflected coupled impedance.
- 3.5 Explain the phenomenon of coupled impedance in single tuned circuits.
- 3.6 Explain the phenomenon of coupled impedance in double tuned circuits.
- 3.7 Define the critical coupling, loose coupling and tight coupling.
- 3.8 Explain the reasons for double humps in tight coupled circuits.
- 3.9 List applications of tuned circuits

4.0 Categorize the four terminal passive networks.

- 4.1 Distinguish between symmetrical and non-symmetrical networks.
- 4.2 Distinguish between balanced and unbalanced networks.
- 4.3 Define characteristic impedance and propagation constant of symmetrical network.
- 4.4 Derive an expression for Z_o of symmetrical T network and mention the Z_o expressions for symmetrical π network
- 4.5 Show that $Z_o = \sqrt{Z_{oc} Z_{sc}}$.
- 4.6 Define Image and iterative impedances of asymmetrical network
- 4.7 Define the decibel and neper and list the relationship.
- 4.8 Define pass band and attenuation band of filters.
- 4.9 Classify filters depending on function and type.
- 4.10 Explain the working of constant K, LPF and HPF (T & π types).
- 4.11 Sketch the curves for frequency versus attenuation, Z_o , phase shift.
- 4.12 Derive the expressions for designing of LPF and HPF (T type) and mention the design expressions for π type.
- 4.13 Design LPF and HPF (T & π types) given cut off frequency and R_o value.
- 4.14 Explain the working of BPF and BSF (T-types).
- 4.15 Sketch frequency versus attenuation curves for BPF, and BSF.
- 4.16 State disadvantages of constant K filters.
- 4.17 Obtain M derived T & π type sections from constant K-Filters.
- 4.18 Interpret the characteristics curves of M derived LPF and HPF sections.

- 4.19 List the advantages of M derived filters.
- 4.20 Sketch the block diagram of composite filter.
- 4.21 Distinguish between the attenuators and filters.
- 4.22 Give simple configurations of T & π type attenuators and mention the expressions for attenuation.
- 4.23 Mention the use of equalizers.
- 4.24 Classify the equalizers.
- 4.25 Draw the simple equalizer circuits and explain.

5.0 Understand different aspects of transmission lines

- 5.1 Distinguish between lumped and distributed parameters.
- 5.2 Define the primary and secondary constants of transmission line.
- 5.3 Relate primary and secondary constants.
- 5.4 Express transmission line as a symmetrical T network.
- 5.5 Define an infinite line.
- 5.6 Derive an expression for Z_0 and propagation constant of transmission line.
- 5.7 Define phase velocity and group velocity and list the relationship between them.
- 5.8 List different wave form distortions in L F lines and mention the cause.
- 5.9 Derive the condition for distortion less transmission line (LF).
- 5.10 Explain loading.
- 5.11 Define reflection coefficient.
- 5.12 Explain the term standing wave.
- 5.13 Define SWR.
- 5.14 Relate SWR and reflection coefficient.

COURSE CONTENTS

1 RESONANCE

Series and parallel resonance conditions for resonance, Q factor effect of resistance on Q Selectivity and band width uses of resonant circuits.

2 NETWORK ANALYSIS AND THEOREMS

Mesh current analysis, Mesh equations solving, Mesh Equation driving point impedance. Node voltage analysis, equation and solutions- Driving point admittance and duality. Superposition theorem, Maximum power transfer theorem, Thevenin's and Norton's theorems, Millman's theorem, applications.

3. COUPLED CIRCUITS

Types of Coupled circuits, coupled circuits dot convention; coupled impedance and single and double tuned coupled circuits, applications.

4. NETWORKS

Four terminal networks, T and Π , balance, unbalanced, symmetrical and Asymmetrical networks, open circuit impedance, short circuit impedance; characteristic impedance, propagation constant, compare between T and Π networks. The decibel and Neper, simple configuration of different types of filters, LPF, HPF, BPF their attenuation and phase characteristics, m derived filters, composite filters, equalizers.

5. TRANSMISSION LINES

Line parameters, primary and secondary constants, infinite line, wave form distortion, distortion less condition, loading, reflection coefficient. Standing waves.

TEXT BOOKS

1. Electric circuits by Joseph.a.Edminister (Schaum's outline series).
2. Transmission lines by Umesh Sinha.

REFERENCE BOOKS

A course in Electrical Circuit Analysis by Sony & Gupta
Electric circuit Analysis by William Hayt , Kemmerly
Network Analysis by Van Valkenberg

DIGITAL ELECTRONICS

Subject Title : Digital Electronics
Subject Code : BM - 304
Periods / Week : 6
Periods / Year : 90

TIME SCHEDULE

Sl. No	Major Topics	No. of Periods	Weightage of Marks	Short Type	Essay Type
1	Number Systems, Logic Gates	18	26	2	2
2	Arithmetic and Combinational logic Circuits	12	16	2	1
3	Logic families	10	13	1	1
4	Flip – flops	20	21	2	1 & 1/2
5	Counters and Registers	12	18	1	1 & 1/2
6	Displays and Semiconductor Memories	18	16	2	1
	Total	90	110	10	8

OBJECTIVES

On completion of the course the student will be able to know

1.0 Comprehend Number systems, Boolean algebra and different logic gates

- 1.1 Review of Number Systems – Positional Number systems, Signed, 1's & 2's Complement Number systems, Substraction using 1's & 2's Complement method, Binary algebra, BCD code, Grey code, Excess 3 code.
- 1.2 State the different postulates in Boolean algebra
- 1.3 Define with truth tables AND, OR and NOT operations
- 1.2 Write Boolean Expressions for the given problem
- 1.5 State De-Morgan's Theorems
- 1.6 Apply De-Morgan's theorem and other postulates of Boolean algebra to simplify the Given Boolean expression
- 1.7 Write Boolean expressions from a given truth table
- 1.8 Use Karnaugh map to simplify Boolean Expressions with and without don't care conditions. (2, 3 and 4 variables only).
- 1.10 Explain the concept of sum of products and product of sums
- 1.11 Explain the working of an Exclusive OR gate, with a truth table
- 1.12 Explain the working of NAND and NOR gates using truth table
- 1.13 Develop AND, OR, NOT, Ex-OR & Ex- NOR gates using NAND gates only and NOR Gates only
- 1.12 Develop simplified logic circuits given in a problem (in statement form or truth table Form) using only NAND or NOR gates.

2.0 Comprehend the working of arithmetic circuits and combinational logic circuit

- 2.1 State the function of Half-adder
- 2.2 Draw Half-adder using an exclusive OR and an AND gate
- 2.3 Show the two Half-adders and an OR gate constitute full adder
- 2.4 Realize the half-adder using only NAND gates or only NOR gates
- 2.5 Draw a 4-bit parallel adder using full adders
- 2.6 Explain the working of the above circuit

- 2.7 Draw a 4-bit parallel adder and 2's complement subtractor circuit
- 2.8 Explain the working of the above circuits
- 2.9 Explain the working of a serial adder with a block diagram
- 2.10 Compare the advantages and disadvantages of a serial adder with a parallel adder
- 2.11 Explain the operation of a digital comparator circuit for a two 2-bit words
- 2.12 Design of 4 to 2 line priority encoder
- 2.13 Illustrate the applications of a multiplexer with a circuit diagram
- 2.14 Design of a 4 to 16-line decoder
- 2.15 Illustrate the application of a de-multiplexer with a circuit diagram
- 2.16 Design various combinational circuits using multiplexers and de-multiplexers
- 2.17 Construct full adder using (3X8) decoders
- 2.18 Construct full adder using two (4X1) multiplexers
- 2.19 Problems on Boolean function implementation using basic gates, universal gates, decoders, multiplexers.

3.0 Comprehend the working of Logic families

- 3.1 Define positive and negative logic families
- 3.2 List the TTL, CMOS, and ECIL families characteristics such as logic levels, Propagation delay, noise margin, fans in & fans out and power dissipation
- 3.3 Draw an open collector TTL NAND gate and explain its working
- 3.4 State the use of pull up resistor
- 3.5 Draw and explain the function of a TTL NAND gate with totem pole output
- 3.6 Draw an ECL gate circuit and explain its working for NOR gate
- 3.7 State the need for a tri-state buffer/NOT gate
- 3.8 Draw the simplified diagram and explain the operation of a tri-state buffer/NOT gate
- 3.9 Draw and explain the function of a CMOS NAND gate circuit
- 3.10 Compare the performance of TTL gate with that of CMOS gate
- 3.11 Compare ECL gates with TTL and CMOS gates

4.0 Comprehend the working of different types of flip - flops

- 4.1 State the basic of operation of flip-flops
- 4.2 Explain the working of a NAND/NOR gate latch
- 4.3 Explain the symbol, characteristic equations, truth tables, excitation tables & the working of RS, T, D & JK flip-flops
- 4.4 Discuss the concepts of edge and level triggering in flip - flops
- 4.5 Distinguish between synchronous and asynchronous inputs of flip-flops and state their functions
- 4.6 State the need of a master slave flip-flop
- 4.7 Explain the working of a master slave flip-flop using suitable diagram and truth table
- 4.8 Analyze the clocked sequential circuits using JK ,D & T flip flops with the help of state equations, state table and state diagrams
- 4.9 Conversion of one type of flip-flop to another type.
- 4.10 List any four applications of flip-flops

5.0 Comprehend the functions of registers and counters and their working

- 5.1 State the need for a register
- 5.2 Explain the transfer of data between registers
- 5.3 Explain the working of serial in-serial out, serial in parallel out registers
- 5.4 Explain the working of shift left, shift right registers
- 5.5 Explain the working of universal shift registers (example 74192 or equivalent)
- 5.6 State the use of shift registers as memory
- 5.7 Distinguish between asynchronous and synchronous counters
- 5.8 Design the circuit of a modulus 8-ripple counter
- 5.9 Explain the counting sequence with waveforms and truth table in the above circuit
- 5.10 Design the circuit of a decade counter
- 5.11 Explain the counting sequence with waveforms and with truth tables in the above circuit
- 5.12 Draw the circuit diagram of a decade counter using 7490 and 7493.
- 5.13 Explain the drawback of ripple counters

- 5.14 Design a 4-bit synchronous counter and explain the operation.
- 5.15 Draw and explain the operation of a up/down counter.
- 5.16 Explain the operation of a programmable counter IC 74163/74193, give the circuit
- 5.17 Draw and explain the operation of 4-bit ring counter circuit
- 5.18 State the applications of counters

6.0 Understand working of display devices and Semiconductor memories

- 6.1 State the use of display circuits using LEDs and LCD
- 6.2 Explain the working principles of LEDs and LCD
- 6.3 Distinguish between common anode and common cathode 7-segment LED display
- 6.4 State the advantages and disadvantages of LED display
- 6.5 State the advantages and disadvantages of LCD display
- 6.6 Mention the dot matrix display arrangement
- 6.7 List the types of memories
- 6.8 Define memory terminology such as Read, Write, Access time, Capacity, Word length, Address, Volatile and Non-volatile memories, Static and Dynamic memories, Random access, Sequential access, read only memories and read/write Memories
- 6.9 Explain the working of a basic bipolar RAM – cell
- 6.10 Explain the working of a basic dynamic CMOS RAM cell
- 6.11 State the advantages and disadvantages of dynamic RAM over static RAM's
- 6.12 Expansions of memories capacity and word size
- 6.13 State the use of PROM
- 6.14 Distinguish between UV EPROM and EPROM

COURSE CONTENTS

1. **Number systems, Logic Gates and Logic families**

Number systems, positive & negative number representations, encoding concepts. AND, OR, NOT, NAND & Exclusive OR, logical definitions, symbols. Boolean expressions using truth tables; simplification of Boolean expressions using De -Morgan's theorems and Boolean algebra, universal gates - formulating and Implementation of logic expressions; Karnaugh map applications involving development of combinational logic circuits.

2. **Arithmetic and Combinational Logic Circuits :**

Implementation of arithmetic circuits of half adder, full adder, serial/parallel binary adders and subtractor circuits, digital comparator, Encoders, decoders, multiplexers and de-multiplexers applications

Logic families :

Positive & Negative logic inputs, TTL logic, open-collector and totem pole output & tristate logic gates,– Propagation delay or speed, noise margin, logic levels, power dissipation, fan - in / fan - out. CMOS circuits and comparison with TTL circuits; basic concepts of ECL (emitter coupled logic).

3. **Flip - Flops :**

Principles of flip-flop operation (with the help of waveform and truth table) RS, D, JK, T and Master slave JK flip-flop. Concept of edge triggering levels triggering, synchronous, asynchronous inputs and their use.

4. **Counters and Registers:**

Basic asynchronous binary and decade counters and their use. Divide by N-counter: programmable counters, up and down counters, ring counters and their use. Counter design

Shift registers, serial in, serial out, and serial in parallel out, parallel in parallel out, parallel in serial out and universal shift registers and applications.

5. Displays and Semiconductor Memories:

Construction, working and operating principles of LED, LCD, seven segment, dot matrix and alphanumeric displays, decoding driver circuits for seven segments displays. Concept of memory using registers; working principles of ROM, PROM, EPROM and EEPROM. Static and Dynamic RAMs, expansions of memories capacity and word size.

TEXT BOOKS

1. Digital Design by Morris Mano
2. Digital principles and Applications by Malvino & Leach(THM)
3. Digital Electronics by Tokheim

REFERENCE BOOKS

1. Digital Electronics by Gothmans
2. Digital Electronics by Walkerly

PROGRAMMING IN 'C'

Subject title	:	PROGRAMMING IN 'C'
Subject Code	:	BM – 305
Periods per Week	:	06
Periods per Semester	:	90

TIME SCHEDULE

Sl.No	Major Topics	No. of periods	Weightage of Marks	Short Answer Questions	Essay Questions
1	C Programming Basics	15	16	2	1
2	Conditional statements and arrays	20	26	2	2
3	Strings, Functions & Pointers	20	26	2	2
4	Structures & Pre-processor Directives	20	26	2	2
5	Basics of MATLAB	15	16	2	1
	Total	90	110	10	08

OBJECTIVES

1.0 C Programming Basics.

- 1.1 List the character set of C language
- 1.2 Explain the data types in C
- 1.3 List the five Arithmetic Operators
- 1.4 Define an expression and show how to evaluate.
- 1.5 Explain writing the assignment statement.

- 1.6 Explain the increment and decrement operators.
- 1.7 Identify compound Assignment Operators.
- 1.8 Explain the Nested assignments.
- 1.9 Explain printf ()and scanf () functions
- 1.10 Mention various type conversion techniques and discuss them.
- 1.11 List the four relational operators.
- 1.12 List the three logical operators supported by 'C'
- 1.13 Give the operator precedence.
- 1.14 Evaluate a logical expression.
- 1.15 Explain bitwise logical operators.

2.0 Conditional Statements & Arrays

- 2.1 State the importance of conditional expression.
- 2.2 List the four conditional statements supported by C
- 2.3 Explain If, If-else and If-else-If statements.
- 2.4 Explain Switch Case statement.
- 2.5 Write simple programs based on conditional statements.
- 2.6 List the three types of iterative statements supported by C.
- 2.7 Explain while loop, Do-While and For loops.
- 2.8 Explain the nested loops
- 2.9 write simple programs based on nested loops
- 2.10 Differentiate break and continue statements.
- 2.11 Mention the use of null statement and comma operator.
- 2.12 Define one dimensional and two dimensional arrays.
- 2.13 Explain the initialization of the above arrays & Access Array elements.
- 2.14 Explain Passing array elements as arguments and arrays as arguments

3.0 Strings, Functions & Pointers

- 3.1 Define string
- 3.2 List three functions used for reading strings
- 3.3 List three functions used for writing strings.
- 3.4 Write the operation of getchar(), getch(), getche() and putchar() functions.

- 3.5 Write the operations of string manipulation functions strcat(), strchr(), strcmp(), strncmp(), strcpy(), and strlen()
- 3.6 Write simple programs based on string manipulation functions
- 3.7 Define a function.
- 3.8 State the use of return statement.
- 3.9 Explain passing parameters to the function
- 3.10 Write programs using function call technique.
- 3.11 List the four storage classes supported by C.
- 3.12 Differentiate local and external variables.
- 3.13 Identify automatic and static variables and discuss them in detail
- 3.14 State the application of external declaration.
- 3.15 Define Recursion and Explain with examples.
- 3.16 Declare a pointer, assign a pointer, and initialize a pointer.
- 3.17 Discuss pointer arithmetic.
- 3.18 Differentiate address and de referencing operators.

4.0 Structures and preprocessor directives

- 4.1 Define a structure
- 4.2 Describe structure variable.
- 4.3 Explain initialization of structures.
- 4.4 Explain the accessing of members of a structure.
- 4.5 Illustrate concept of structure assignment
- 4.6 Explain how to find size of a structure.
- 4.7 Discuss nested structure concept.
- 4.8 Define a Union
- 4.9 Explain the use of a union.
- 4.10 List six unconditional preprocessor directives.
- 4.11 List six conditional preprocessor directives.
- 4.12 Explain the preprocessing directives: define, include, ifdef, ifndef.

5.0 Understanding MATLAB Basics

- 5.1 State the need for MATLAB in solving engineering problems
- 5.2 List the features of MATLAB
- 5.3 List the arithmetic operators, relational operators, logical operators and special operators in MATLAB
- 5.4 List the data types in MATLAB
- 5.5 Explain the syntax and usage of decision making statements : i) if...end statement; ii) if..else..end statement; iii) If... elseif...elseif...else...end statement iv) switch statements used in MATLAB
- 5.6 Explain the syntax and usage of loop statements : i) while loop ii) for loop used in MATLAB
- 5.7 Explain the creation 1D & 2D arrays and mXn matrices in MATLAB
- 5.8 Illustrate with an example the matrix operations such as : i) addition ;ii) subtraction; iii) multiplication; iv) transpose and v) inverse using MATLAB
- 5.9 List the common input/output functions in MATLAB.
- 5.10 Illustrate plot commands such as: i) plot(x,y) ;ii) fplot() iii) title(); iv) xlabel(); v) ylabel(); vi) legend() in MATLAB
- 5.11 List any TEN different basic tool boxes related to electronics & communication engg. applications in MATLAB
- 5.12 What is SIMULINK and list its uses in engineering applications

COURSE CONTENT

1. C-Programming Basics

Structure of a C programme, Programming rules, Character Set, Delimiters Keywords, Constants, Variables, Data types, Type conversion. Arithmetic, Logical, Relational operators and precedence – Assignment, Increment, Decrement operators, evaluation of expressions. Console IO formatted and unformatted functions.

2. Decision and Loop control Statements and arrays

If, If-else, Nested If else, Break, Continue, Goto and Switch statements Loops:- For, While, Do-while, Nesting of Loops. 1 D Array declaration, Initialization, 2 D Array declaration, Initialization, Accessing of Array elements

3. Strings and Functions and pointers in C

,Character Arrays declaration and Initialization of Strings, Display of strings with format.Function-Definition, Declaration, Return statement, passing parameters to function- Function calls, Nesting of functions and Recursion Storage classes of variables, Scope and visibility. Pointer declaration, Arithmetic operations and pointers, Pointers and Arrays

4. Structures, Unions and preprocessor directives

Structure features, Declaration and Initialization, Structure within a structure, Array of structure, Accessing of Structure members, Structures and functions, Unions. Preprocessor directives.

5. Matlab Basics

Matlab elements –data types – operators-relational, logical - decision making statements – loop statements –arrays and matrices -working with matrices – input/output functions – plotting commands- uses

REFERENCE BOOKS

1. Programming in ANSI C,Balaguru Swamy.E , 3rd Edition, TMH
2. Programming with ANSI and Turbo C by Kamthane, Pearson Education
3. Programming in C by Gottfried (Schaum Series)
4. Programming in C by Reema Thareja, Oxford university press.
5. Let us C, by Yashwant Kanetkar, BPB Publication, New Delhi
Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by Pratap, Oxford University Press, 2014

Communication Skills Practice

Subject title	:	Communication Skills Practice
Subject code	:	BM-306
Periods per week	:	3
Periods / Semester	:	45

Introduction :

In the context of globalization , competence in speaking skills is the need of the hour
The gap between the needs of the industry and the curriculum can be bridged by enabling the students to hone their speaking and listening skills. This course aims at providing opportunities for practicing speaking.

Objectives :

On completion of the course the students will be able to

- Strengthen their listening skills
- Strengthen their speaking skills

Time Schedule

Sno.	Topic	Periods	Weightage of marks (End Exam)	Sessional marks	Total
1	Listening I	3	10	10	20
2	Listening II	3			
3	Introducing oneself	3	50	30	80
4	Describing objects	3			
5	Describing events	3			
6	Reporting past incidents	3			
7	Speaking from observation / reading	3			
8	JAM	6			
9	Group discussion	6			
10	Mock interviews	6			
11	Making presentations	6	60	40	100
		45			

Competencies and key competencies to be achieved by the student

Topic	Teacher's input/ methodology	Students competence
Listening I Listening II	Pre- Listening –eliciting, pictures While - Listening Post –Listening –project , writing	Identifying the main idea, Identifying specific details, Identifying parallel and contradictory ideas Drawing inferences, Reasoning
Introducing oneself	Kinds of introduction --official/ personal, dynamic vocabulary, Body language, Model introduction, Use of line ups	Use of simple present tense, Sequencing, Appropriate vocabulary
Reporting incidents	Group work /pair work, Elicit, Use of past tense, Student presentations	Use of past tense, Relevant vocabulary

Describing objects	Vocabulary , Use of adjectives, Games—I spy, Group presentations	Use of adjectives, Dimensions,shapes Compare and contrast, sequence
Describing events	Group work/pair work Use of appropriate tense	Use of appropriate tense, sequencing
Reporting past incidents	Use of past tense, Vocabulary Student presentations	Use of past tense , sequencing
Speaking from	Group work/pair work, Reading techniques ,	Use of past tense, Summarising , evaluating,

observation/ reading		comprehension
JAM	Effective techniques , Good beginning , conclusion, tips, Use of line ups	Vocabulary, Sequencing, Fluency, Thinking spontaneously
Group discussion	Expressing opinion, body language,	Expressing opinion, agree/ disagree, fluency,Persuasive and leadership skills
Mock interview	FAQs , body language	Role play, body language,
Making presentations	Student presentations	Using charts , pictures, interpreting data, sequencing,PPTs

Communicative methodology (CLT) should be used to create an interactive class. Apart from the suggestions given teachers are free to innovate to use any activity to improve the language competence of students . Attention can also be given to improve the accent and intonation of students.

Note:

* This subject is a theory subject.

** The workload should be calculated as theory workload.

***Examinations in the subject will be treated as a practical one.

ELECTRONIC CIRCUITS AND NETWORKS LAB PRACTICE

Subject title : **Electronic Circuits and Network Analysis Lab Practice**
Subject code : **BM-307**
Periods per week : **3**
Periods / Semester : **45**

List of Experiments:

S. No.	Major Topics	No. of Periods
	Part A	
1.	Transistor Amplifiers	6
2.	Negative feedback amplifiers	6
3.	Class A,B,C amplifiers	6
4	Oscillators	6
	Part B	
5	Using Electronic measuring equipment and resonance	3
6	verification of Network theorems	6
7	Networks	6
8	Filters and Attenuators	6
	Total	45

List of Experiments

PART A

1. Plot the frequency response characteristics of a RC coupled Amplifier.
 - a) Calculate the gain, f_1 , f_2 and band width from the response. Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion.
 - b) Measure the voltage across Emitter Resistance using CRO, with and without emitter bypass capacitor C_e

- c) Measuring the output power using ac power meter
- 2. Measure the effective Beta for the Darlington pair
- 3. Plot the frequency response characteristics of negative feedback Amplifier.
 - a) Calculate the gain, f_1 , f_2 and band width from the response.
 - b) Observe the effect of feedback on gain, f_1 , f_2 and band width for voltage series, current shunt, voltage shunt, current series feedback
- 4. To determine the effective current gain of a Darlington Pair
 - a) Connect two BC148 transistors in a Darlington pair and calculate the effective Beta
- 5. To determine the efficiency of class A, B C amplifier
- 6. To observe the output of a tuned circuit oscillator and identify the oscillator type from the components in the circuit
 - a) Colpitt's oscillator and Hartley oscillator
 - b) crystal oscillator circuit

PART B

- 1. To measure the component values(R,L,C) using LCR meter
- 2. To plot resonant curves of a tuned circuit
 - a) Series Resonance., b) Parallel Resonance.
- 3. Verification of Network theorems-I
 - a) Thevenin's theorem. b) Nortons theorem
- 4. Verification of Network theorems-II
 - c) Super position theorem. d) Maximum power transfer theorem.
- 5. To Measure Z_o of Symmetrical T and π networks
- 6. Design and implement a constant-K Low pass filter with a cut off frequency of 10 KHz(or any other frequency) and evaluate the performance
- 7. Design and implement a constant-K High pass filter with a cut off frequency of 10 KHz(or any other frequency) and evaluate the performance
- 8. Design and Realize T-type Attenuator circuit and determine the actual attenuation

Objectives and Key Competencies

Exp NO	Name of the Experiment	Objectives	Key Competencies
PART A			
1	Frequency response characteristics of a RC coupled Amplifier.	<ol style="list-style-type: none"> 1. Assemble the circuit as per the circuit diagram 2. Identify the coupling and bypass capacitors (types, values) 3. Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion. 4. Measure the voltage across load using CRO by varying frequency 5. Measure the voltage across Emitter Resistance using CRO, with and without emitter bypass capacitor C_e 6) Measuring the output power using ac power meter by varying frequency 7 draw the frequency response characteristics of a RC coupled Amplifier on semi log graph sheet. 	<ol style="list-style-type: none"> 1 Calculating the gain in db 2. Plot the frequency response characteristics of a RC coupled Amplifier on semi log graph sheet and also on normal graph sheet. 2. Calculate the 3db points, f_1, f_2 and band width from the response. 3. Observing the distortion (clipping) of signal on CRO and adjusting the input for distortionless output
2	Darlington pair	<ol style="list-style-type: none"> 1. Connect two BC148 transistors in a Darlington pair and calculate the effective Beta 2. Find out the device specifications of TIP 120 from the data sheets and compare the h_{fe} with that of BD 139. 3. Connect Darlington Pair circuit 5. Measure the voltage across load using CRO by varying frequency 4. Calculating the Effective Beta from individual Betas of the transistors 	<ol style="list-style-type: none"> 1. Measure the voltage across load using CRO 2. Calculating the Effective Beta from individual Betas of the transistors

3	Frequency response characteristics of negative feedback Amplifier.	<ol style="list-style-type: none"> 1. Assemble the circuit as per the circuit diagram 2. Measure the voltage across load using CRO by varying frequency 3. Measure the output voltage across load using CRO, with and without feedback by varying frequency 4. Calculating the gain in db 5. Draw the frequency response characteristics of a negative feedback Amplifier on semi log graph sheet. 6. Calculate band width 7. Compare the responses with and without feed back 	<ol style="list-style-type: none"> 1. Calculate the gain in db 2. Draw the frequency response characteristics of a negative feedback Amplifier 3. Calculate band width 4. Compare the bandwidth and gain with and without feed back
4	Tuned circuit oscillators	<ol style="list-style-type: none"> 1. Assemble the circuit as per the circuit diagram 2. Identifying Tuned circuit and feed back circuit 3. Observing the waveforms on CRO 4. Observe the effect of varying the core of inductor 	<ol style="list-style-type: none"> 1. observe the output of a tuned circuit oscillator and identify the type from the components in the circuit 2. Observe the waveforms on CRO 3. Calculate frequency of oscillations
5	Colpitt's oscillator Hartley oscillator crystal oscillator	<ol style="list-style-type: none"> 1. Assemble the circuit as per the circuit diagram 2. Identify the type of circuit and feed back circuit 3. Observing the waveforms on CRO 4. Observe the effect of varying the core of inductor or capacitor 	<ol style="list-style-type: none"> 1. observe the output of a oscillator and identify the type from the components in the circuit 2. Observe the waveforms on CRO 3. Calculate frequency of oscillation
6	Class A,B,C amplifiers	<ol style="list-style-type: none"> 1. Assemble the circuit as per the circuit diagram 2. Identify the type of operation by adjusting base bias 	<ol style="list-style-type: none"> 1. identify the type of operation by adjusting base bias 2. Observe output

		3. Observe output waveforms on CRO for class A, B, C amplifiers 4. Measure the output voltage across load 5. Calculate efficiency	waveforms on CRO for class A, B, C amplifiers 3. Calculate efficiency
PART B			
Exp No	Name of the Experiment	Objectives	Key competencies
1.	Measurement of the component values using special equipment a) Use of Digital LCR meter to measure RLC & Q	a) To identify the RLC Digital RLC meter and note the front panel controls. b) Measure component values by selecting the proper mode and range	a) Identify RLC meters b) Using the digital RLC meter
2.	Resonance curves of a tuned circuit a) Series Resonance., b) Parallel Resonance.	a) To identify the TUNED circuit components b) connect L and C to form a series and parallel resonant circuit c) Plot the resonant curves d) Calculate the resonant frequency and BW and verify with measured values e) compare series and parallel resonances	a) performing the experiment as per procedure b) Observe that the resonant circuit acts as a frequency selector and magnifier.
3.	Verification of Network theorems-I a) Thevenin's theorem. b) Norton's theorem	To Verify above Network theorems. Estimate the voltages & currents in a circuit element when multiple sources are involved Understand the importance of Thevenin's impedance and applying the knowledge in analogue circuits Reinforce the skills of using Voltmeters and Ammeters Connecting the Components as per the circuit Follow the sequence of procedure	Perform the experiment as per procedure and analyze the reasons for errors Correlate the Experimental knowledge in the Electronic circuits.
4	Verification of Network theorems-II	To Verify above Network theorems. Estimate the voltages & currents when multiple sources	Perform the experiment as per procedure and analyze

	<p>a) Verification of Super position theorem.</p> <p>b) Verification of Maximum power transfer theorem</p>	<p>are involved. Understand the importance of impedance matching and applying the knowledge in analogue circuits. Reinforce the skills of using Voltmeters and Ammeters</p> <p>Connecting the Components as per the circuit. Follow the sequence of procedure</p>	<p>the reasons for errors</p> <p>Correlate the Experimental knowledge in the Electronic circuits</p>
5	Measurement of Z_o of Symmetrical T and π networks	<p>a) To identify the Symmetrical T and π networks</p> <p>b) Measure Z_o of symmetrical T and π networks</p>	<p>Know the formulas for Z_o of symmetrical T and π networks</p>
6	Design and implement a Low pass filter with a cut off frequency of 10 KHz (or any other frequency) and evaluate the performance	<p>To Know the purpose of filters and Types</p> <p>Know the formulas for Filter Design</p> <p>Know the specifications of Filters</p> <p>To understand the filter design</p> <p>Evaluate the performance of constant k filters (observe the limitations)</p> <p>Observe and locate 3db points on the response curve</p>	<p>Know the formulas for Filter Design</p> <p>Designing Constant K filters for a given cut off frequency</p>
7	Design and implement a High pass filter with a cut off frequency of 10 KHz (or any other frequency) and evaluate the performance	<p>To Know the purpose of filters and Types</p> <p>Know the formulas for Filter Design</p> <p>Know the specifications of Filters</p> <p>To understand the filter design</p> <p>Evaluate the performance of constant k filters (observe the limitations)</p> <p>Observe and locate 3db points on the response curve</p>	<p>Know the formulas for Filter Design</p> <p>Designing Constant K filters for a given cut off frequency</p>
8.	Design and Realize T-type Attenuator circuit and determine the actual attenuation.	<p>Know the Function of Attenuator</p> <p>Know the formulas used for attenuator design (impedance matching criterion)</p> <p>Know the specifications of attenuator</p> <p>Using dB measurements/ calculations</p> <p>Implementing attenuator and evaluating performance</p>	<p>Designing attenuator with required specifications and evaluation</p>

DIGITAL ELECTRONICS LAB PRACTICE

Subject Title : Digital Electronics Lab Practice
Subject Code : BM-308
Periods/Week : 03
Periods/Semester : 45

S. No.	Major Topics	No. of Periods
I.	Basic Gates	9
II.	Arithmetic & Logical Circuits	9
III.	Combinational Logic Circuits	9
IV.	Latches & Flip flops	6
V.	Counters	6
VI	Registers	6
		45

LIST OF EXPERIMENTS

- 1. Identification of Digital ICs and noting down pin details from data sheets**
 - a) Identify the given digital ICs and draw the pin diagrams. (use TTL and CMOS ICs of AND, OR, NOT, NAND, NOR and XOR gates with two and three inputs)
 - b) Realize basic gate functions using toggle switches and a bulb
- 2. Verify the truth tables of AND, OR, NOT, NAND, NOR and XOR Gates**
 - a) Verify the Functionality of Different logic gates and Write the corresponding truth table
 - b) Measure threshold voltages resulting in change of a state of a NAND gate
 - c) Verify the truth table of 7403 IC and give your observations
- 3. Realize AND , OR , NOT , XOR functions using 2 input NAND and NOR TTL Gates**
 - a) From the data sheets find out CMOS Equivalent of above ICs
 - b) Implement a 4bit complement generator using 7486 quad XOR IC
 - c) Realize a simple comparator using XOR Gate
 - d) Realize a NOT gate using XOR gate

4. Arithmetic & Logical Circuits

Implement Half adder, Half Subtractor, full adder and full Subtractor circuits using TTL gates and verify the truth tables

5. To study the Features of 74138 Decoder IC

- a) Verify the function of 74138 decoder IC.
- b) Combine two 3 to 8 decoder to realize a 4 to 16 Decoder

6. To study the Features of 74148 Encoder IC

- a) Verify the function of 74148 Encoder
- b) Combine two 74148 Encoder

7. To Verify the Functions of Multiplexer and De multiplexers (Using IC 74153&IC 74154)

- a) Understand the function of Multiplexer and demultiplexer
- b) Implement the given function using IC 74153 and 74154
- c) Combine two Multiplexers

8. To Verify the function of 4-bit magnitude comparator 7485IC.

- a) Verify the effect of giving different logic inputs to pins 2,3,4 of IC
- b) Realize a simple 2bit comparator using XOR Gate

9. To Construct and verify the truth tables of NAND & NOR latches

- a) Realize a Bistable element with two NOT gates and a Feedback Resistor
- b) Implement a bounce Elimination switch using the above Gates

10. To Construct clocked RS FF using NAND gates and Verify its truth table.

- a) Verify the truth table of CD 4013 Dual D flip Flop
- b) Verify the functionality and truth table of 74L71 RS flip flop with Preset and Clear
- c) Verify the Truth table of JK FF using 7476 IC.
- d) Construct D and T flip flops using 7476 and verify the truth tables.
- e) Verify the function of octal latch 74LS373

11. To Construct and verify the function of decade counter using 7490 ICs.

- a) change the modulus of the counter
- b) display decimal number using 7447

c) From data sheets Find out other Types of counter ICs available and their Pin configuration

12. To Verify the function of up/down counter using 74190, 74193

- a) change the modulus of the counter and verify
- b) Verify the Functionality of CD4029 up/down counter
- c) Use the Preset inputs of CD4029 Counter

13. To Verify the function of Johnson counter using CD 4017 IC

- a) Change the modulus of the counter
- b) Design a Frequency divider circuit using 4017 IC
- c) Implement running LED circuit with 4017 IC

14. To Verify the function of shift register (ICs like 7495, 74194 etc.)

Expt. No.	Experiment Name	Objectives	Key Competencies
I.	Basic Gates	a) Identify the given digital ICs and draw the pin diagrams. (use TTL and CMOS ICs of AND, OR, NOT NAND, NOR and XOR gates with two and three inputs) b) Realize basic gate functions using toggle switches and a bulb c) Verify the Functionality of Different logic gates and write the corresponding truth table d) Measure threshold voltages resulting in change of a state of a NAND gate e) Verify the truth table of 7403 IC and give your observations f) From the data sheets find out CMOS Equivalent of above ICs g) Implement a 4bit complement generator using 7486 quad XOR IC h) Realize a simple comparator using XOR Gate i) Realize a NOT gate using XOR gate	1. Able to identify the IC nos. 2. Able to connect ICs on breadboards 3. Able to observe the functions of all basic gates with their truth tables.

II.	Arithmetic & Logical Circuits	Implement Half adder, Half Subtractor, full adder and full Subtractor circuits using TTL gates and verify the truth tables	<ol style="list-style-type: none"> 1. Able to identify the appropriate kit 2. Able to identify the available ICs on the kit for each experiment 3. Able to read the connections 4. Able to observe the functionality of the circuit with truth table.
III.	COMBINATIONAL LOGIC CIRCUITS	<ol style="list-style-type: none"> a) Verify the function of 74138 decoder IC. b) Combine two 3 to 8 decoder to realize a 4 to 16 Decoder c) Verify the function of 74148 Encoder d) Combine two 74148 Encoder e) Understand the function of Multiplexer and demultiplexer f) Implement the given function using IC 74153 and 74154 g) Combine two Multiplexers h) Verify the effect of giving different logic inputs to pins 2,3,4 of IC i) Realize a simple 2bit comparator using XOR Gate 	<ol style="list-style-type: none"> 1. Able to identify the appropriate kit 2. Able to identify the available ICs on the kit for each experiment 3. Able to read the connections 4. Able to observe the functionality of the circuit with truth table.
IV.	LATCHES & FLIP FLOPS	<ol style="list-style-type: none"> a) Realize a Bistable element with two NOT gates and a Feedback Resistor b) Implement a bounce Elimination switch using the above Gates c) Verify the truth table of CD 4013 Dual D flip Flop d) Verify the functionality and truth table of 74L71 RS flip flop with Preset and Clear e) Verify the Truth table of JK FF using 7476 IC. f) Construct D and T flip flops using 7476 and verify the truth tables. g) Verify the function of octal latch 74LS373 	<ol style="list-style-type: none"> 1. Able to identify the appropriate kit 2. Able to identify the available ICs on the kit for each experiment 3. Able to read the connections 4. Able to observe the functionality of the circuit with truth table.

V.	COUNTERS	a) change the modulus of the counter b) display decimal number using 7447 c) From data sheets Find out other Types of counter ICs available and their Pin configuration d) change the modulus of the counter and verify e) Verify the Functionality of CD4029 up/down counter f) Use the Preset inputs of CD4029 Counter g) Change the modulus of the counter h) Design a Frequency divider circuit using 4017 IC i) Implement running LED circuit with 4017 IC	1. Able to identify the appropriate kit 2. Able to identify the available ICs on the kit for each experiment 3. Able to read the connections 4. Able to observe the functionality of the circuit with truth table.
VI	SHIFT REGISTERS	a) Identification of ICs like 7495, 74194 b) Verify the functionality of the above ICs	1. Able to identify the appropriate kit 2. Able to identify the available ICs on the kit for each experiment 3. Able to read the connections 4. Able to observe the functionality of the circuit with truth table.

Programming in C & MATLAB Practice

Subject Title	:	Programming in C & MATLAB
Subject Code	:	BM- 309
Periods/Week	:	03
Periods/Semester	:	45

TIME SCHEDULE

Sl	Major Topic	No. of Periods
1	C Programming Basics	6
2	Decision & Loop Control Statements	6
3	Exercises on functions	9
4	Arrays, Strings and Pointers in C	9
5	Structures, Unions & Preprocessor Directives	6
6	MAT Lab Practice	9

LIST OF EXPERIMENTS

I. C Programming Basics

1. Familiarize with turbo Compiler features.
2. Practice formatted Input / Output (printf and scanf) functions.
3. Practice with Various Operators in C

II. Decision & Loop Control Statements

4. Practice with Decision & Control (if, if-else, nested if –else) Statements
5. Practice with Decision control (Switch –case structure) statements
6. Practice with loop control Statements

III. Exercises on functions

7. Practice the use of functions in C

IV. Arrays, Strings and Pointers in C

8. Write and run small programs using single dimensional integer arrays
9. Write and run small programs using multidimensional integer arrays .
10. Write and run small programs using string functions for string comparison, copying and concatenation
11. Write and run small programs using with pointers in 'C'

V. Structures, Unions & Preprocessor Directives

12. Write and run small programs using Structures in C
13. Write and run small programs using C preprocessor Directives.
14. Practice command line arguments in C

VI. MAT LAB PRACTICE

- 15 Familiarize with MATLAB Compiler environment, command line arguments, HELP and know about various tool boxes available in MATLAB
- 16 Write simple programs on decision making statements (if-end, if-else-end, nested if –else-end)
- 17 Write simple programs on loop control statements (while , for loops)
- 18 Write simple programs to create simple 1D & 2D arrays and perform addition & subtraction operations
- 19 Write simple programs to create 3X3 matrixes and perform : i) addition ;ii) subtraction; iii) multiplication; iv) transpose and v) inverse operations
- 20 Write simple programs to illustrate plot commands such as: i) plot(x,y) ;ii) fplot() iii) title(); iv) xlabel(); v) ylabel(); vi) legend() in MATLAB

IV SEMESTER

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
FOURTH SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination				
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks	
BM-401	Linear Integrated Circuits Applications	6	--	90	3	20	80	100	
BM-402	Communication & Data Transmission	6	--	90	3	20	80	100	
BM-403	Microprocessors & interfacing	6	--	90	3	20	80	100	
BM-404	Physiological Systems Engineering	6	--	90	3	20	80	100	
BM-405	Bio-Medical Instrumentation	6	--	90	3	20	80	100	
BM-406	LIC & ECAD Lab Practice	--	3	45	3	40	60	100	
BM-407	Communication & Data Transmission Lab Practice	--	3	45	3	40	60	100	
BM-408	Microprocessors & interfacing Lab	--	3	45	3	40	60	100	
BM-409	Biomedical Instrumentation lab	--	3	45	3	40	60	100	
		30	12	630		260	640	900	

LINEAR INTEGRATED CIRCUITS APPLICATIONS

Subject Title : **LINEAR INTEGRATED CIRCUITS APPLICATIONS**
Subject Code : **BM- 401**
Periods/Week : **06**
Periods/Year : **90**

Sl. No	Major Topics	No. Of Periods	Weightage of Marks	Short Type	Essay Type
1	Oscillators	18	21	2	1.5
2	Wave shaping circuits	24	26	2	2
3	Multivibrators	18	21	2	1.5
4	Operational Amplifiers	18	26	2	2
5	A/D and D/A Converters	12	16	2	1
	Total	90	110	10	8

OBJECTIVES

On Completion of the course the student will be able to

1.0 Understand the Working of Oscillator.

- 1.1 Define an electronic oscillator
- 1.2 Classify different oscillators on the basis of principle of operation, Waveform generation, and frequency and associated circuits parameters.
- 1.3 Explain the condition for an amplifier to oscillate.
- 1.4 Illustrate Barkhausen criterion for oscillators.
- 1.5 Illustrate the reasons for instability of oscillators.
- 1.6 Illustrate the remedies for Instability of oscillators
- 1.7 Sketch the circuits of Hartley, Collpitt's, tuned collector and crystal oscillators (using Transistors)
- 1.8 Illustrate the condition of sustained oscillations for the above oscillators
- 1.9 Derive the expressions for frequency of oscillations for Hartley & Colpitts oscillators.
- 1.10 Sketch the circuits of RC phase shift and Wein bridge type audio oscillators.

- 1.11 Derive the expression for frequency of oscillations of the above circuits
- 1.12 Discuss the condition of sustained oscillations of the above oscillators
- 1.13 Compare the merits and demerits of RC phase shift and wein bridge oscillators.
- 1.14 Define negative resistance of an active device.
- 1.15 Explain using suitable waveforms, the operation of an oscillator using negative resistance devices like UJT and tunnel diode with circuits.
- 1.16 Sketch and explain the working of blocking oscillator and know its applications.

2.0 Under stand wave shaping circuits.

- 2.1 Define the term linear wave shaping
- 2.2 Define time constant of a RC circuit
- 2.3 Calculate transient voltage and current in RC circuit at any instant.
- 2.4 Define the terms pulse width, rise time, fall time, duration, tilt, overshoot, undershoot, frequency, PRR, PRT, PRF and duty cycle with reference to a pulse and pulse train.
- 2.5 Sketch high pass RC circuit
- 2.6 Predict the response of high pass RC circuit
- 2.7 Illustrate the expression for the lower 3db frequency f_1
- 2.8 Analyze a high pass RC circuit as differentiator
- 2.9 Explain the working of differentiator
- 2.10 List the factors on which the output noise of a differentiator circuit depend
- 2.11 Choose the RC components of a differentiator circuit for the given output wave form
- 2.12 Sketch a RC low pass circuit
- 2.13 Sketch the output voltage wave shape for a low pass RC circuit for a step pulse and square wave input voltages
- 2.14 Indicate the expression for upper 3 db frequency, f_2
- 2.15 Indicate the rise time expression
- 2.16 Analyze a low pass RC circuit as an integrator.
- 2.17 Explain the operation of integrator circuit.

- 2.18 Explain the applications of integrator and differentiator.
- 2.19 Explain the term Non-linear wave shaping.
- 2.20 Classify the clipping circuit using junction diode on the basis of limiting levels of the input signal.
- 2.21 Sketch the diode clipper circuit and draw the transfer characteristics.
- 2.22 Explain the operation of series, shunt biased clipper circuits.
- 2.23 Sketch the double diode clipper or slicer circuit.
- 2.24 Calculate the bias resistance for proper clipping action in a diode clipper circuit.
- 2.25 Sketch a Zener diode clipper for clipping at any level on both positive and negative half cycle and double clipping.
- 2.26 Explain the operation of above circuit.
- 2.27 Sketch and explain the diode clamper circuit for a given waveform.
- 2.28 List the applications of clipper and clamper circuits.

3.0 Understand the Working of a Multivibrator.

- 3.1 Sketch the circuit diagram of a transistor switch.
- 3.2 Explain the working of above circuit using CE output characteristics.
- 3.3 Classify the Multivibrators on the basis of their operating point Stability
- 3.4 Sketch the circuit of Bistable Multivibrator using transistor .
- 3.5 Explain the working of above circuits.
- 3.6 Sketch and explain the Monostable circuit using transistor.
- 3.7 Describe the gating action of Mono-stable circuit.
- 3.8 Sketch and explain the circuit of Schmitt trigger using transistors.
- 3.9 Sketch and explain Astable Multivibrator using transistor .
- 3.10 Express the frequency of above mentioned Multivibrators.
- 3.11 Sketch the AMV & MMV using IC 555

4.0 Understand the characteristics of the operational amplifier.

- 4.1 Describe the circuit of differential amplifier.
- 4.2 Explain the operation of differential amplifier.
- 4.3 List the basic specifications of ideal operational amplifier.

- 4.4 Explain the operational amplifier.
- 4.5 Define A_V , Z_O , Z_I , bandwidth, input offset voltage and give their typical values for an ideal operational amplifier.
- 4.6 Define CMRR.
- 4.7 Discuss the need for high CMRR
- 4.8 List the limitations of differential amplifier constructed using discrete components
- 4.9 Discriminate how an integrated operational amplifier circuit overcomes the limitations of discrete operational amplifier.
- 4.10 Sketch the block diagram and list the different blocks in operational amplifier
- 4.11 Sketch the circuit and list the different stages in the integrated amplifier
- 4.12 Sketch the pin diagram of metal IC package and dual in line package for typical IC CA 721 or equivalent.
- 4.13 Discuss the power supply requirements for an operational amplifier
- 4.14 Define the terms input offset voltage, input offset current, input bias current, input resistance, input capacitance, offset voltage adjustment range, supply voltage rejection ratio, output voltage swing, large signal voltage gain, slew rate, gain bandwidth product, supply current with reference to operational amplifier.
- 4.15 Describe the open loop operations of an operational amplifier.
- 4.16 Discuss the effects of negative feedback on an operational amplifier
- 4.17 Sketch the circuits of non-inverting, inverting operational amplifier,
- 4.18 Describe the operation of above circuits.
- 4.19 Sketch the circuits of summing amplifier, difference amplifier, voltage follower and differentiator, integrator, comparator, Voltage-current converter, current-Voltage converter.
- 4.20 Describe the operation of above circuits.
- 4.21 Discuss the limitations of passive filters
- 4.22 Describe briefly about active filters
- 4.23 Sketch and describe circuits of LPF, HPF, BPF first & second order using OPAMP.

- 4.24 Sketch and explain circuits of Astable, Monostable, Bistable multivibrators and Schmitt trigger using OP-amp.
- 4.25 Sketch and explain saw tooth generator circuit using Op-amp.
- 4.26 Explain the need for linear time base generator.
- 4.27 Define sweep signal.
- 4.28 Distinguish between voltage time base and current time base generators
- 4.29 Sketch a simple current sweep circuit using transistor and explain its operation.
- 4.30 Sketch and explain Bootstrap sweep circuit, Miller sweep circuit using Op-amp.
- 4.31 Sketch the input and output waveforms for Miller and Bootstrap sweep circuits.
- 4.32 List the applications of sweep circuits.

5.0 Understand A/D and D/A Converters.

- 5.1 State the need for A/D and D/A converters.
- 5.2 Explain the terms resolution, Accuracy, Monotonicity and settling time of D/A converter.
- 5.3 Explain D/A conversion using binary weighted resistors.
- 5.4 Explain D/A conversion using R-2R ladder network.
- 5.5 Explain A/D conversion using counter method.
- 5.6 Explain A/D conversion using successive approximate method

COURSE CONTENTS

1. OSCILLATORS:

Sinusoidal oscillators - LC oscillators - tuned collector oscillator, Hartley, Colpits and crystal oscillators - RC phase shift, Wein bridge Oscillators, negative resistance oscillators – tunnel diode, UJT, blocking oscillator.

2. WAVE SHAPING CIRCUITS :

Specifications of pulse and pulse waveform, review of transients in RC circuits, differentiator and integrator circuits. Clipping circuits using diodes and Zener diodes, clipping at various levels, double clipping. Clamping circuits using diodes.

3. MULTIVIBRATORS :

Transistor as a switch, transistor Bistable Multivibrator, and Schmitt trigger, collector coupled Monostable Multivibrators, wave forms, gating period calculations, triggering, maximum frequency, collector coupled Astable Multivibrator, wave form, frequency calculations.

4. OPERATIONAL AMPLIFIER:

Differential amplifiers, block diagram of operational amplifiers, definition of input offset voltage, input offset current, bias current, differential input resistance, input capacitance, and offset voltage adjustment range, CMRR, SVR, SR, GBW, equivalent circuit of OP-amp. Summer, voltage follower, difference amplifier, comparator, Integrator, differentiator, active filters first & second order, Voltage to current converter, current to voltage converter. . Op-amp circuits for Schmitt trigger, monostable and astable circuits -Miller and bootstrap sweep circuits, current sweep circuit, active filters first & second order

5. A/D and D/A Converters

A/D and D/A Converters, define the terms resolution, Accuracy, Monotonicity and settling time of D/A converter. DAC and ADC using op-Amps

TEXT BOOKS

1. Principles of electronics by Malvino
2. Electronic Devices and circuits by Milliman & Halkies
3. Pulse, digital and switching waveform by Milliman and Taub
4. Operational Amplifiers and Linear Integrated circuits by Ramakanth Gayakwad

REFERENCE BOOKS

1. Applied Electronics by G.K. Mithal
2. Pulse fundamentals by John Doyle
3. Pulse and wave shaping circuits by Agarwal.
4. Basic Electronics And Linear circuits by N.N. Bhargava, D.C Kulshreshtha, S.C.Gupta.

COMMUNICATION AND DATA TRANSMISSION

Subject Title : **Communication and Data Transmission**
Subject Code : **BM - 402**
Periods / Week : **6**
Periods / Year : **90**

TIME SCHEDULE

Sl. No	Major Topics	No. of Periods	Weightage of Marks	Short type	Essay type
1	Modulation methods	16	19	3	1
2	Transmitters and receivers	18	23	1	2
3	Antennas and wave propagation	22	26	2	2
4	Fundamentals of digital communication	12	16	2	1
5	Digital data modulation and demodulation	22	26	2	2
	Total	90	110	10	08

OBJECTIVES

1.0 Understand modulation methods used in communication systems

- 1.1 Know the electromagnetic spectrum
- 1.2 Explain the need for modulation in communication system
- 1.3 Classify different modulation schemes
- 1.4 Define AM, FM, PM
- 1.5 Sketch the waveforms of above systems
- 1.6 Derive all the mathematical expressions for AM
- 1.7 Derive all the mathematical expressions for FM
- 1.8 State the need for pre emphasis and de emphasis in FM
- 1.9 Explain SSB modulations

- 1.10 Explain generation of SSB using phase shift method and weaver method
- 1.11 Explain vestigial sideband (VSB) transmission
- 1.12 State sampling theorem
- 1.13 List the types of pulse modulation methods with waveforms
- 1.17 List the merits, demerits and applications of above modulation schemes

2.0 Transmitters and Receivers

- 2.1 Give the classification of radio transmitters
- 2.2 Explain the block diagram of AM transmitters
- 2.3 Explain the working principle of FM transmitters with AFC
- 2.5 Explain the working principle of indirect FM transmitters
- 2.6 Give the classification of radio receivers
- 2.7 Explain the working principle of super heterodyne receiver
- 2.8 Explain the working principle of FM receiver
- 2.9 Describe quantization process to obtain PCM signal
- 2.10 Explain about quantization noise in PCM and methods to reduce it
- 2.11 Describe the working principle of PCM system with the aid of block diagram

Understand principles of Antenna and wave propagation

- 3.1 State the purpose of an antenna
- 3.2 Explain the radiation of electromagnetic (EM) waves from an antenna.
- 3.3 Sketch the voltage and current distribution in a wire antenna
- 3.4 State the purpose of antenna array and mention its types
- 3.5 Define the following terms with respect to antenna: Antenna gain, antenna resistance, Radiated power, radiation Pattern, beam width, aperture area, effective length, efficiency and polarization.
- 3.6 Explain resonant and non resonant antennas
- 3.7 Explain the effects of antenna height
- 3.8 Explain the effect of ground on antennas
- 3.9 Explain linear, circular and elliptical polarization of antennas
- 3.10 Explain impedance matching of antenna with feed and transmission line
- 3.11 List the various types of antennas based on frequency

- 3.12 Mention the various methods of wave propagation
- 3.13 Explain ground wave, space wave & sky wave propagation.
- 3.14 Explain the basic block diagram of satellite communication system
- 3.15 Describe the basic RADAR set

4.0 Understand the fundamentals of Digital communication

- 4.1 Types of Noise.
- 4.2 Explain SNR, noise figure, noise temperature and their importance
- 4.3 Explain the effect of noise on digital data communication system
- 4.4 Explain about error control
- 4.5 Explain error detection codes
- 4.6 Explain error correction codes in detail: ARQ, FEC, block codes
- 4.7 Define the terms average information, information rate and channel capacity
- 4.8 State the relation between information rate and channel capacity
- 4.9 List the advantages of digital transmission

5.0 Digital data modulation and demodulation methods

- 5.1 State modes of data transfer
- 5.2 List the modulation techniques used in digital data transmission: ASK, FSK, PSK, DPSK QPSK and QAM with waveforms
- 5.3 Explain the methods for generating and demodulating the following signals.
 - i) ASK ii) FSK iii) PSK iv) DPSK v) QPSK vi) QAM
- 5.5 Mention the need for multiplexing and types of multiplexing
- 5.6 Explain the principle of TDM and FDM
- 5.7 Explain the working principle of TDM with block diagram
- 5.8 Explain the working principle of FDM with block diagram

COURSE CONTENTS

- 1. Modulation methods:** Need for modulation in communication system. Elementary concepts of AM, FM, PM, PAM, PWM, PPM mention SSB and vestigial side bands, applications of above modulation schemes
- 2. Transmitters, receivers :** Classification of Transmitters, A.M, SSB, F.M. block diagram of different transmitters and their specifications, function of each block, Classification of receivers, receiver block diagram for reception of AM and FM signals. PCM system
- 3. Antennas and wave propagation:** Fundamentals of antenna, Defining important terms with respect to antenna., Resonant and non resonant antenna, Effects of antenna height, Effect of Ground on antennas, Ground ,space wave & sky wave propagation. Basic block diagram of Satellite and radar systems
- 4. Fundamentals of Digital Communications :** Types of Noise, SNR, noise figure, Noise temperature with their importance, Effect of noise on digital data communication ,error control, error detection codes, error correction codes: ARQ, Hamming code, Block codes, Average information, information rate and channel capacity. Relation between information rate and channel capacity
- 5 Digital data modulation and demodulation methods:** Modulation techniques used in digital data transmission like ASK, FSK, PSK, DPSK, QPSK, QAM with waveforms, Methods for generating and demodulating ASK, FSK, PSK, DPSK, QPSK, QAM. Types of multiplexing, TDM, FDM systems.

Text Books

1. Electronic Communication Systems by George Kennedy
2. Electronic Communication by Shroader
3. Electronic Communication by Roddy & Coolen
4. Electronic Communication Systems by Wayne Tomasi

Reference Books:

1. Electronic Communication Systems by Kennedy Davis
2. Data Communication and Networking by Behrouz Forouzan(3 rd edition)

MICROPROCESSORS AND INTERFACES

Subject Title	:	Micro- Processors and Interfaces
Subject Code	:	BM - 403
Periods per Week	:	06
Periods per Semester	:	90

TIME SCHEDULE

S.No	Major Topics	No. of periods	Weightage of Marks	Short Type	Essay Type
1	8086 Architecture	20	26	2	2
2	Programming on 8086	25	29	3	2
3	Interfacing	20	26	2	2
4	80286,386,486 Architecture and features.	20	21	2	1.5
5	Introduction to Core-technologies	05	08	1	0.5
	Total	90	110	10	8

OBJECTIVES:

1.0 Understand Architecture of 8086 Processor

- 1.1 Identify the differences between microcomputer and microprocessor
- 1.2 Describe the structure and operation of a microcomputer
- 1.3 Identify the microprocessor evolution and types
- 1.4 Give the advantages of 16 bit processors over 8 bit processors like 8085
- 1.5 Identify features of 16 bit Intel and other 16 bit processors (Motorola)
- 1.6 Know the functional differences between 8086 and 8088
- 1.7 Draw the internal block diagram of 8086
- 1.8 Explain functioning of BIU and EU
- 1.9 Know the importance of instruction queue
- 1.10 Know about the importance of segment registers

- 1.11 Know the use of pointer registers
- 1.12 Explain how to generate 20 bit physical address
- 1.13 Draw flag register and state function of each flag
- 1.14 Know the importance of memory segmentation
- 1.15 Draw PIN out diagram of 8086 and state function of each pin
- 1.16 Draw and explain BUS organization in MIN mode
- 1.17 Draw and explain timing diagrams for read and write operations in MIN mode
- 1.18 Draw and explain BUS organization in MAX mode
- 1.19 Draw and explain timing diagrams for read and write operations in MAX mode
- 1.20 Explain the interrupt types used in 8086
- 1.21 Explain the interrupt response of 8086 microprocessor
- 1.22 Explain the interrupt vector table of 8086 microprocessor
- 1.23 Discuss the priority of 8086 interrupts

2.0 Know assembly language programming on 8086

- 2.1 Know various instruction formats
- 2.2 Explain various addressing modes of 8086
- 2.3 Explain Data Transfer Instructions with examples
- 2.4 Explain constructing machine codes for MOV instruction for different addressing modes
- 2.5 Explain various Arithmetic Instructions with examples
- 2.6 Explain bit manipulation Instructions
- 2.7 Explain string instructions with examples
- 2.8 Explain with examples various program execution transfer Instructions
- 2.9 Explain processor control instructions
- 2.10 Know about DOS interrupts from INT0 to INT21
- 2.11 Know how to write a program and a standard program format.
- 2.12 Know various assembler directives.
- 2.13 Write simple programs using assembler directives
- 2.14 Write programs using the instructions in the instruction set of 8086

- 2.15 Explain the debugging methods of an assembly language program
- 2.16 Calculate instruction execution timing for register to register addition and register to memory addition
- 2.17 Explain the calculation of time delay using loop instructions
- 2.18 Write a delay loop which produces a specified time delay with 8086
- 2.19 Define procedure, macro and parameters
- 2.20 Give the differences between procedure and macro
- 2.21 Explain the program flow for single and nested procedures
- 2.22 Explain the four different ways of passing parameters to and from a procedure with examples
- 2.23 Know about the reentrant and recursive procedures
- 2.24 Explain the program execution flow for reentrant procedure
- 2.25 Explain the program execution flow for recursive procedure with an example
- 2.26 Explain passing parameters to macros

3.0 Know the interfacing of Peripherals

- 3.0 Explain the need for Interfacing
- 3.1 Classify Interfacing peripherals
- 3.2 Explain the functional block diagram of 8255.
- 3.3 Explain the concept of CWR (Control Word Register).
- 3.4 Illustrate the control word with suitable examples
- 3.5 Explain interfacing of 8255 with microprocessor
- 3.6 State the features of 8279
- 3.7 Explain the functional block diagram of 8279.
- 3.8 Exemplify interfacing 8279 with microprocessor
- 3.9 State the features of 8257
- 3.10 Explain the functional block diagram of DMA controller 8257.
- 3.11 Illustrate interfacing 8257 with microprocessor
- 3.12 Explain the need for Communication interface
- 3.13 Know the functional block diagram of 8251

- 3.14 Explain interfacing 8251 with microprocessor
- 3.15 State the features of 8259
- 3.16 Explain the functional block diagram of 8259
- 3.17 Explain interfacing 8259 with microprocessor
- 3.18 Understand RS – 232 standard.
- 3.19 Explain serial communication through 8086 using RS 232

4.0 Understand the Architecture of 80286 and features of 386 , 486

- 4.2 State the features of 80286 microprocessor
- 4.3 Describe the architecture of 80286.
- 4.4 Explain operating modes of 80286
- 4.5 Describe memory management of 80286.
- 4.6 State the features of 80386
- 4.7 Describe pipe lining.
- 4.8 Describe instruction level parallelism.
- 4.9 Describe and compare RISC and CISC.
- 4.10 State the features of 80486

5.0 Introduction to Multi Core-technologies

- 5.1 State importance of Multi-core Technology
- 5.2 Discuss features of Multi-core Technology
- 5.3 List the applications of Multi-core Technology
- 5.4 List Multi-core Processors
- 5.5 Explain function of Dual core processor

COURSE CONTENTS

1. 8086 Architecture

Block diagram – CPU architecture – Pin diagram of 8086/88 Internal operation
– System bus architecture of 8086 in minimum & maximum modes –interrupt structure of 8086

2 Programming of 8086

Addressing modes - Instruction formats and Instruction set of 8086 -
Assembly language programming & programming with procedures & macros

3. Interfacing of Peripheral ICs.

Know the function, features, pin details and interfacing of 8255,8279, 8257,
8251, 8259.RS-232C

4. Architecture of 80286, 386 ,486 and Pentium

Features of all processors- Architectures of 80286, 386 , 486 and Pentium –
Operating modes -Memory organization in 286 and 386, Super scalar architecture,

5. Introduction to Multi Core-technologies

Single core and Multi core technologies

TEXT BOOKS

1. The Intel Microprocessors – Barry and Brey (6th ed)
2. Microprocessors and Interfaces – Douglas V. Hall(3rd ed)

REFERENCE BOOKS

1. The 8086/8087 family Microprocessors – Yu Cheng Liu Glen A. Gibson
2. Microprocessor Architecture, and Applications - Ramesh S.Gaonkar

PHYSIOLOGICAL SYSTEMS ENGINEERING

Subject Title : **Physiological systems Engineering**
Subject code : **BM-404**
Periods Per Week : **06**
Periods Per Semester : **90**

TIME SCHEDULE

SI.No.	Major Topics	Periods	Weightage of Marks	Short type	Essay type
1.	Organization of the Human Body	15	16	2	1
2.	Principles of Support and Movement	20	26	2	2
3.	Control Systems of the Human Body	10	13	1	1
4.	Maintenance of the Human Body	30	39	3	3
5.	Interpret the functioning of Special senses	15	16	2	1
	TOTAL	90	110	10	8

OBJECTIVES

On completion of the course the student will be able to

Organization of the Human body

- 1.1 Describe the human body organization.
- 1.2 List and define the planes of reference – saggital, frontal, transverse
- 1.3 Define the directional terms – superior, inferior, anterior, posterior medial, lateral, internal, external, proximal, distal, pronation and supination.
- 1.4 Describe the structure of a cell
- 1.5 Describe the functions of the cell

- 1.6 Define resting potential.
- 1.7 Constituents of blood and their normal ranges
- 1.8 Explain the significance of Blood Analysis

2.0 Apply the Principles of Support and Movement on Human body

- 2.1 State the functions of the skeletal system
- 2.2 Explain the structure of a skeleton.
- 2.3 Identify bones of the human body
- 2.4 List the types of bones with examples. .
- 2.5 Classification of joints with examples
- 2.6 Explain possible movements at the different types of joints.
- 2.7 Name different joints of the body.
- 2.8 Apply different movements of joints on the human body
- 2.9 List the functions of muscular system.
- 2.10 Explain the types of muscles.
- 2.11 Compare types of muscles.
- 2.12 Explain the mechanism of muscular contraction.

3.0 Understand Control Systems of the Human Body

- 3.1 Explain the structure of a neuron.
- 3.2 Define action potential of a neuron.
- 3.3 Name the cable properties of the nerve.
- 3.4 Explain conduction of nerve impulses in unmyelinated and myelinated nerve fibers.
- 3.5 Explain synapse and neuromuscular junction.
- 3.6 Explain Anatomy of the brain with liable diagram.
- 3.7 Name different lobes of the brain and state their functions.
- 3.8 Explain Electrical activity of the brain

4.0 Appraise the Maintenance of the Human Body

- 4.1 Identify the location of the heart
- 4.2 Explain the structure of heart wall and it's layers, chambers and valves.
- 4.3 Explain various circulations – systemic , pulmonary, coronary and portal circulation

- 4.4 List the Functions of major blood vessels
- 4.5 Explain the events in the cardiac cycle
- 4.6 Calculate the heart rate for given cardiac cycle
- 4.7 Explain electrical activity of the heart
- 4.8 Explain conduction system of the heart
- 4.9 Examine suitable circulations in the conduction system of the heart
- 4.10 Explain the structure and functions of respiratory System
- 4.11 Explain the mechanism of breathing
- 4.12 Define lung volumes and capacities
- 4.13 Explain the functions of the digestive system, secretion, digestion and absorption
- 4.14 Draw & Explain the structure of the digestive system
- 4.15 Draw & Explain the functional anatomy of a kidney
- 4.16 Draw and label the structure of nephron
- 4.17 Explain the functioning of a nephron
- 4.18 Explain the structure of Urinary system
- 4.19 Explain the functioning of the urinary system

5.0 Interpret the functioning of Special senses

- 5.1 List the organs for special senses
- 5.2 List the Accessory Structures of the Eye
- 5.3 Explain the accessory structures of the eye
- 5.4 Explain the structural components of the Eye ball.
- 5.5 Define refraction , accommodation and Constriction of the pupil
- 5.6 Apply the above in Image Formation by the pupil
- 5.7 Explain the processing of visual signals in the Retina and the neural pathway for vision
- 5.8 Draw & Explain the anatomical structure of the Ear
- 5.9 List the Major events in the Physiology of Hearing.
- 5.10 Explain the Physiology of equilibrium in Ear
- 5.11 Explain about Cochlear implants.

COURSE CONTENTS

- 1. Organization of the human body :** Cellular level , Tissue level, Organ level, planes of reference , directional terms, Cell Structure, Organelles and functions. Blood Composition and functions. Significance of blood analysis in Medicine.
- 2. Principles of Support and Movement :** Functions and structure of the skeletal system, types of bones, joints, and their classification , different joints of the body. Functions of muscular system, types of muscles and their comparison, mechanism of muscular contraction.
- 3. Control System of the Human Body:** Structure and functions of neuron, action potential, conduction of nerve, impulses, synapse and neuromuscular junction, structures and lobes of the brain.
- 4. Maintenance of the Human Body:** Structure and function of the heart, major blood vessels in system pulmonary and coronary circulation, cardiac cycle, Electrical activity of the heart Organs of respiration and their function, mechanics of breathing , lung volumes and capacities. Functions of the digestive system. Functional anatomy of a kidney, structure and functions of nephron.
- 5. Special Senses:** Organs for special senses, mechanism vision and hearing.

TEXTBOOKS

1. Concepts of Human Anatomy and Physiology - Kent. M. Van de graff and Stuart Ira (Mc Graw Hill)
2. Spears Anatomy and Physiology for Nurses - Smith and Windod.

REFERENCE BOOKS

1. Principles of Anatomy and Physiology By Tortora and Grabowski.

BIOMEDICAL INSTRUMENTATION

Subject Title	:	Biomedical Instrumentation
Subject Code	:	BM-405
Periods Per Week	:	06
Periods Per Semester	:	90

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short type	Essay type
1.	Characteristics of biomedical Instrumentation	15	21	2	1.5
2.	Bio medical Transducers	25	29	3	2
3.	Bio potential Electrodes	15	21	2	1.5
4.	Amplifiers for biomedical applications	20	23	1	2
5.	Recorders and display devices for biomedical signals	15	16	2	1
	TOTAL	90	110	10	8

OBJECTIVES

1.0 Understand the characteristics of bio-medical instrumentation

- 1.1 Explain general instrumentation system.
- 1.2 Explain the block diagram of medical instrumentation system.
- 1.3 Compare a general instrumentation system with a medical instrumentation system
- 1.4 Explain the constraints while measuring physiological variables
- 1.5 Define all the general static characteristics of medical instruments like linearity, range, accuracy, precision, frequency response, stability, signal to noise ratio, hysteresis.
- 1.6 State physiological signals and their amplitude and frequency ranges.

2.0 Principles and applications of various transducers used in medical equipment.

- 2.1 Define and Classify Transducers.
- 2.2 Explain operating principles and applications of variable resistance transducers.
- 2.3 Explain constructional details and operating principles of bonded and unbonded strain gauges
- 2.4 Derive the gauge factor of strain gauge.
- 2.5 List the biomedical applications of strain gauges
- 2.6 Explain the constructional details of variable inductance transducers.
- 2.7 Explain the operating principle and applications of variable inductance transducers
- 2.8 Explain the constructional details and operating principles of an LVDT
- 2.9 State the need for a phase sensitive detector
- 2.10 Explain the constructional details, operating principle and applications of variable capacitance transducers
- 2.11 Explain the constructional details and operating principle of piezoelectric transducers and their applications
- 2.12 List various transducers used in temperature measurement
- 2.13 State the Principle of thermocouple,
- 2.14 State Seebeck and Peltier effect
- 2.15 State the thermocouple laws
- 2.16 Give the resistance temperature relationship of a thermistor
- 2.17 State principle and applications of resistance thermometers
- 2.18 State the principle of optical transducers, Photo-diode, Photo-Multiplier tube, Photoconductive, Photo-voltaic, Photo-Emissive

3.0 Operate principles and applications of bio-potential electrodes

- 3.1 State the need for a bio-potential electrode
- 3.2 Distinguish between electrode and transducer
- 3.3 Explain the electrode-electrolyte interface
- 3.4 Explain the electrode skin interface

- 3.5 Definition of half-cell potential and explain its measurement
- 3.6 List the values of half cell potentials for various metals
- 3.7 Define Offset voltage and explain its minimization with Ag-AgCl electrodes
- 3.8 Explain Equivalent circuit of a surface electrode in contact with skin
- 3.9 Classify the Bio-potential electrodes
- 3.10 Explain the types of body surface electrodes
- 3.11 Explain the various internal electrodes (needle & wire electrodes)
- 3.12 Explain the construction and applications of microelectrode

4.0 Principles and applications of amplifiers used in medical equipment

- 4.1 State requirements of a bio-potential amplifier
- 4.2 List the properties of an Ideal op-amp
- 4.3 Draw the circuit of op-amp differential amplifier and derivation of the expression for output voltage
- 4.4 Draw circuit diagram and explain the working of an instrumentation amplifier (three op-amp differential amplifier)
- 4.5 Draw Circuit diagram and explain working principle of carrier amplifier
- 4.6 Explain the working of a chopper amplifier with a circuit diagram
- 4.7 Explain working of Transformer, optical, and Capacitive-coupled isolation amplifiers.

5.0 Various recorders and display devices for biomedical signals

- 5.1 State the need for a recorder in a measurement system
- 5.2 List the recorders based on the frequency response
- 5.3 Explain the working principle of a galvanometric recorder
- 5.4 Describe the Working of an ink jet recorder
- 5.5 Explain the Principle of a thermal recorder
- 5.6 List the Applications of all the recorders
- 5.7 Explain the significance of CRO in Biomedical field.
- 5.8 Compare faded and Non-faded displays

COURSE CONTENTS:

- 1.0 Introduction to Biomedical instrumentation:** block diagram general characteristics of medical instrumentation like linearity range accuracy, precision, frequency response, stability SNR, hysteresis etc. comparison with general instrumentation system important physiological signals & their ranges
- 2.0 Biomedical transducers:** Classification of transducers principles of operation and applications of different types of transducers variable resistance, variable inductance, variable capacitance, piezo-electric, thermistors thermocouples, RTD, optical transducers
- 3.0 Bio-potential electrodes electrode:** Electrolyte interface, electrode – skin interface, offset voltage and half-cell potential, equivalent circuit of an electrode principles of operation and applications of surface, needle & wire, and micro electrodes
- 4.0 Amplifiers for biomedical applications:** Operation & applications of operational amplifier, instrumentation amplifier, differential amplifier, carrier amplifier chopper, isolation amplifiers.
- 5.0 Recorders & Display devices for biomedical signals:** Operation & applications of ink jet recorder, thermal recorders, thermal array recorders, optical recorders

TEXT BOOKS

1. Medical Instrumentation – Application & Design John G. Webster
Houghton Mifflin Company
2. Handbook of Biomedical Instrumentation R.S. Khandpur Tata Mc Graw Hill.

REFERENCE BOOKS

1. Biomedical Instrumentation Vol I N. Mohan Murali O.U. Press

2. Handbook of Analytical Instruments R.S. Khandpur Tata Mc Graw Hill

Linear Integrated Circuits & ECAD Lab

Subject title : **Linear Integrated Circuits & ECAD Lab**
Subject code : **BM-406**
Periods per week : **3**
Periods / Semester : **45**

TIME SCHEDULE

SI NO	Major Topics	Periods
1	Study of AF and RF oscillators	15
2	Study of various op-amp applications & IC 555	15
3	Circuit simulation using Pspice or equivalent	15
	Total	45

PART 1

List of the Experiments

1. **A. Colpits Oscillator - Calculate the frequency of oscillations and compare with the theoretical values.**
 - B. Hartley Oscillator - Calculate the frequency of oscillations and compare with the theoretical values.
 - C. RC- Phase Shift oscillator - Calculate the frequency of oscillations and compare with the theoretical values.
 - D. Wein-Bridge Oscillator - Calculate the frequency of oscillations and compare with the theoretical values.
2. Verify the output of summing amplifier using operational amplifier.
3. Verify the output of difference amplifier using operational amplifier.
4. Verify the output of differentiator circuit for different time constants and draw its output waveforms using op-amp.
5. Verify the output of integrator circuit for different time constants and draw its output waveforms using op-amp.
6. Verify the output of comparator using op-amp.

7. Verify the operation of voltage to current converter using op-amp.
Verify the operation of current to voltage converter using op-amp.
8. Calculate the duty cycle of output waveform for Astable Multivibrator using IC 555.
9. Verify the output of table Monostable Multivibrator using IC 555.

Part 2

Circuit Simulation using pspice

- 1) Representation of passive elements
- 2) Representation of active elements
- 3) Representation of time varying signals
- 4) Representation of nodes
- 5) Zener regulator
- 6) Half wave rectifier
- 7) BJT model description
- 8) BJT I/V characteristics
- 9) Simulation of CE amplifier
- 10) Simulation of RC Coupled amplifier
- 11) Simulation of integrator
- 12) Simulation of differentiator

Exp No	Name of the Experiment	Objectives	Key competencies
1	Collipitts, Hartley, Wein bridge, RC phase shift oscillator	<ol style="list-style-type: none"> 1. Able to identify the transistor ,feed back circuit 2. Able to read the circuit connections 3. Able to identify the suitable adaptor for the kit 	

		<ol style="list-style-type: none"> 4. Able to connect the adaptor to the kit 5. Able to calculate the theoretical frequency from the circuit 6. Able to set the CRO(getting DC baseline) 7. Able to know the procedure 	<ol style="list-style-type: none"> 1. Able to get the sine output in CRO 2. Able to compare theoretical and practical values 3. Writing the reports 4. Draw the graph
2	Summing amplifier using op-amp	<ol style="list-style-type: none"> 1. Identify the suitable op-amp 2. Identify the input output pins of op-amp 3. Able to identify the suitable adaptor for the kit 4. Able to read the circuit connections 5. Able to give the inputs 6. Able to use multi meters 	<ol style="list-style-type: none"> 1. Making circuit connection 2. Able to get the output voltage 3. Compare the theoretical summing values and practical summing values 4. Writing the report 5. Writing the tabular form
3	Difference amplifier using op-amp	<ol style="list-style-type: none"> 1. Op-amp identification 2. To study the circuit connections 3. Able to identify the inverting and non- inverting input of an op-amp 4. Able to apply an input to a suitable terminal 5. Able to use the multi meter in suitable voltage or current range 	<ol style="list-style-type: none"> 1. Able to connect as per the circuit diagram 2. Able to measure output voltage from output 3. To write the procedure
4	Differentiator using op-amp	<ol style="list-style-type: none"> 1. To read the circuit connection 2. Performing the experiment as per procedure 3. able to get the suitable output waveform for a given input signal 4. Observing the variation on the 	<ol style="list-style-type: none"> 1. Able to write the procedure 2. Able to get the output waveform for different RC values 3. Draw interference from the observed.

		output by varying "t" from 'T'=RC	
5	Integrator using op-amp	<ol style="list-style-type: none"> 1. To read the circuit connection 2. Performing the experiment as per procedure 3. able to get the suitable output waveform for a given input signal 4. Observing the variation on the output by varying "t" from 'T'=RC 	<ol style="list-style-type: none"> 1. Able to write the procedure 2. Able to get the output waveform for different RC values 3. draw inference from the observed
6	Comparator using op-amp	<ol style="list-style-type: none"> 1. Performing the experiment as per the procedure 2. Able to give input voltages to read the comparison 3. Able to observe waveform on CRO 4. Know the purpose of CRO 	<ol style="list-style-type: none"> 1. Able to write procedure 2. Able to compare different inputs. 3. Draw inference from the observed waveform
7	Voltage to current converter and current to voltage converter using op-amp	<ol style="list-style-type: none"> 1. To know the use of op-amp for converting current to voltage and voltage to current 2. Able to make circuit connections 3. Able to select suitable ranges of voltages and currents using multi meters 	<ol style="list-style-type: none"> 1. Able to understand the equivalent values of current for the voltage or voltage for the current 2. Verify the output with a suitable relation 3. Able to write the report
8	Astable multi vibrator IC555	<ol style="list-style-type: none"> 1. Familiarize with 555 pin configuration 2. Performing the experiment as per the procedure 	<ol style="list-style-type: none"> 1. Draw inference from the observed waveforms 2. Able to write the procedure

		<ul style="list-style-type: none"> 3. Observing the waveforms on CRO 4. Observing the effect of changing R,C component values 5. Observe waveforms at pins 2,3&5 6. Observe the effect of applying a voltage to pin5 7. Observe the effect of connecting pin4 to ground 	<ul style="list-style-type: none"> 3. Able to calculate the duty cycle
9.	Monostable multivibrator using IC555	<p>Familiarize with 555 pin configuration</p> <ul style="list-style-type: none"> 1. Performing the experiment as per the procedure 2. Observing the waveforms on CRO 3. Observing the effect of changing R,C component values 4. Observe waveforms at pins 2,3&5 5. Observe the effect of applying a voltage to pin5 6. Observe the effect of connecting pin4 to ground 	<ul style="list-style-type: none"> 1. Draw inference from the observed waveforms 2. Able to write the procedure 3. Able to calculate the duty cycle

PART B

10	Representation of passive elements	<ul style="list-style-type: none"> a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files 	Using Pspice for circuit simulation
11	Representation of active elements	<ul style="list-style-type: none"> a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit 	Using Pspice for circuit simulation

		<ul style="list-style-type: none"> e) simulating the circuit f) Observing and interpreting results g) Saving the files 	
12	Representation of time varying signals	<ul style="list-style-type: none"> a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files 	Using Pspice for circuit simulation
13	Representation of nodes	<ul style="list-style-type: none"> a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files 	Using Pspice for circuit simulation
14	Zener regulator	<ul style="list-style-type: none"> a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files 	Using Pspice for circuit simulation
15	Half wave rectifier	<ul style="list-style-type: none"> a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results 	Using Pspice for circuit simulation

		g) Saving the files	
16	BJT model description	a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
17	BJT I/V characteristics	a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
18	Simulation of CE amplifier	a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
19	Simulation of RC Coupled amplifier	a) Familiarity with computer operation b) Familiarity with Pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results	Using Pspice for circuit simulation

		g) Saving the files	
20	Simulation of Integrator	a) Defining circuit parameters b) Modelling the circuit c) simulating the circuit d) Observing and interpreting results for different time constant e) Saving the files	Using Pspice for circuit simulation
21	Simulation of Differentiator	a) Defining circuit parameters b) Modelling the circuit c) simulating the circuit d) Observing and interpreting results for different time constant e) Saving the files	Using Pspice for circuit simulation

COMMUNICATION & DATA TRANSMISSION LAB PRACTICE

Subject Title : **Communication & Data Transmission Lab Practice**
Subject Code : **BM-407**
Hours/Week : **03**
Hours/Semester: **45**

TIME SCHEDULE

SI NO	Major Topics	Periods
1	Analog Modulation and demodulation methods	25
2	Digital modulation and Demodulation methods	20
	Total	45

ANALOG MODULATION

- 1 Simple method Generation of AM and detection
- 2 Simple method Generation of FM and detection
- 3 Generation of DSBSC/SSB and detection
- 4 To study AM transmitter and Receiver
- 5 To study FM transmitter and Receiver

DIGITAL MODULATION

1. Generation and detection of PAM
2. Pulse code modulation and Demodulation
3. Pulse width modulation and Demodulation
4. Generation and detection of FSK
5. Generation and detection of PSK
6. Generation and detection of DPSK
7. Generation and detection of QPSK
8. Study of TDM and observe the output waveform
9. Observe the effect of noise on analog system

S.N o	NAME OF THE EXPERIMENT	OBJECTIVES	KEY COMPETENCIES
ANALOG MODULATION			
1	Simple method Generation of AM and detection	<ol style="list-style-type: none"> 1. observing carrier and modulating signal 2. observing circuit components 3. observing AM modulated signal 4. observing demodulated circuit 5. observing output of demodulated circuit 6. Observing the different sections in the circuit 	To perform the experiment as per procedure and calculate modulation index.
2	Simple method Generation of FM and detection	<ol style="list-style-type: none"> 1. Measuring the amplitude and frequency of carrier and modulating signals 2. Observing the frequency deviation 3. Observing different blocks 4. Observing demodulated signal and comparing with original modulation signal. 	<ul style="list-style-type: none"> • To perform the experiment as per procedure • Identifying frequency modulated signal • Measuring frequency deviation and calculating modulation index.
3	Generation of DSBSC/SSB and detection	<ol style="list-style-type: none"> 1. 1. observing suppression of carrier 2. observing one side band (after suppression of carrier) 3. observing the balanced modulator circuit. 	To perform the experiment as per procedure Identifying the a) Modulating signal b) Output waveforms before filtering c) Output waveforms after filtering

4	To study AM transmitter and Receiver	1. To identify the various blocks in transmitter and receiver	To perform the experiment as per procedure To draw the output waveforms at output of each block
5	To study FM transmitter and Receiver	1. To identify the various blocks in transmitter and receiver	To perform the experiment as per procedure To draw the output waveforms at output of each block
DIGITAL MODULATION			
6	Generation and detection of PAM	<ol style="list-style-type: none"> 1. To understand the process of PAM 2. To pulse amplitude modulate the input sinusoidal signal. 3. To observe the waveforms on CRO. 4. To demodulate PAM signal and to recover original signal. 	To perform the experiment as per procedure To identify PAM signal
7	Pulse code modulation and Demodulation	<ol style="list-style-type: none"> 1. To understand the process of PCM 2. To know the process of Quantization by experimental verification 3. To observe the input and output waveforms on CRO. 4. Observing the effect of quantization on CRO. 5. To identify different sections in PCM decoder. 	To perform the experiment as per procedure Identifying the quantization signal. Drawing input and output waveforms.

8	Pulse width modulation and Demodulation	<ol style="list-style-type: none"> 1. To understand the process of PWM 2. To know the process of PWM through experiment 3. To PW modulate input signal 4. To demodulate the PWM signal and recover the modulating signal 5. To identify the various sections in the circuit 	To perform the experiment as per procedure, analyzing, observing and drawing input and output waveforms.
9	Generation and detection of FSK	<ol style="list-style-type: none"> 1. To know the process of FSK by experiment 2. To transmit data using FSK 3. To identify various sections in the circuit 	To perform the experiment as per procedure, analyzing, and observing waveforms.
10	Generation and detection of PSK	<ol style="list-style-type: none"> 1. To know the process of PSK by experiment 2. To transmit data using PSK 3. To identify various sections in the circuit 	To perform the experiment as per procedure, analyzing, and observing waveforms.
11	Generation and detection of DPSK	<ol style="list-style-type: none"> 1. To identify various components in DBPSK transmitter 2. To identify various components in BPSK modulator 3. To identify various components in DBPSK receiver 	<p>To perform the experiment as per procedure</p> <p>To note the outputs of DBPSK modulator and receiver</p>

12	Generation and detection of QPSK	To identify various components in QPSK circuit	<ul style="list-style-type: none"> • To perform the experiment as per procedure • To note the outputs of QPSK modulator and receiver
13	Study of TDM and observe the output waveform	<ol style="list-style-type: none"> 1. Compare head process of TDM by experiment 2. to transmit 4 signals of sinewave 250Hz, 500Hz, 1KHz, 2KHz using TDM 3. To identify various sections in TDM 4. Demultiplex TDM signal and observe the waveform 	To perform the experiment as per procedure
14	Observe the effect of noise on analog system	<ol style="list-style-type: none"> 1. Calculate noise figure 	To perform the experiment as per procedure

MICROPROCESSORS LAB PRACTICE

SUBJECT TITLE : **MICROPROCESSORSLAB PRACTICE**
SUBJECT CODE : **BM-408**
PERIODS/WEEK : **03**
PERIODS/SEMESTER : **45**

TIME SCHEDULE

S. No.	EXPERIMENT	No. of Periods
1.	Demonstration of Microprocessor trainer kit and Desk Top Computer system using MASM or TASM	9
2.	Simple programs using data transfer, arithmetic, logical and branch instructions	12
3.	Programs using Procedures and parameter passing	12
4.	Programs using Interrupts, Monitor or display routines and other software application	12
	Total	45

LIST OF EXPERIMENTS

- 1. Working with microprocessor trainer kits and usage of MASM or TASM assembler software on computer system.**
 - a) Familiarization of 8086 Microprocessor trainer Kit and its usage
 - b) Demonstration of implementing the program on the trainer kit, data implementation, execution and verification of the result.
 - c) Familiarization of Desk top Computer system using either MASM or TASM assembler software.
 - d) Familiarization of software development tools: Editor, assembler, Linker and Debugger

- e) Demonstration of implementation of the program on EDITOR, assembling the program on ASSEMBLER, making object file format through LINKER , execution through DEBUGGER and verification of the result
- f) Demonstrate the selection of memory location at an address, entering the data in the location and its verification
- g) Implement a simple program for demonstration and verify the result through different memory addressing methods

2. Practicing simple programs of 8086

- a) 1's complement and 2's complement of 16-bit numbers
- b) Addition, subtraction, division and multiplication of 16-bit numbers
- c) BCD addition of decimal data
- d) Finding the Largest or smallest number from given 8-bit data array
- e) Arranging the 8-bit data array in Ascending or Descending order
- f) Conversion of Binary Gray code
- g) LCM of two 16-bit unsigned numbers
- h) Factorial of 8-bit data
- i) Multibyte addition
- j) Square root of number
- k) Separation of even and odd numbers from the given 8-bit data array
- l) Evaluation of logical expression

3. Practicing the programs using Procedures and Parameter passing

- a) Simple program of adding two numbers using Global data stored in memory
Accessible to all modules
- b) Simple program of using Call by Value and Reference using Stack variables
- c) Simple program involving passing and returning values using register variables
- d) Conversion of BCD number to a Binary number
- e) simple program that uses a CALL lookup table using procedures

4. Practicing the programs using Interrupts, Display routines and other applications

- a) Displaying the message on the monitor screen with procedure DISP
- b) Program with a sequence used to call System software that uses parameters stored in stack frame
- c) Digital software clock

Exp No	Name of the Experiment	Objectives	Key Competencies
1	Demonstration of Microprocessor trainer kit and Desk Top Computer system using MASM or TASM	Familiarization of trainer kit and Assembler software on computer system	Observing the software development tools and conversion of the assembling files into others
2	Simple programs using data transfer, arithmetic, logical and branch instructions	<ul style="list-style-type: none"> a) Practicing all assembling language b) instructions and directives c) Implementation of the program d) Providing the data in the respective memory locations e) Verification of the result. 	<ul style="list-style-type: none"> a) Observing the output and verification of the result with theoretical values b) Improving programming methodology
3	Programs using Procedures and parameter passing	<ul style="list-style-type: none"> a) Practicing assembling language programs with various procedures and parameters b) Practice using Stack variables 	Identifying the results through parameter passing and look up tables
4	Programs using Interrupts, Monitor or display routines and other software applications	Practice the programs with advanced concepts	Observe the displaying the result of messages

BIO MEDICAL INSTRUMENTATION LAB PRACTICE

Subject title : **Biomedical Instrumentation Lab Practice**
Subject Code : **BM-409**
Periods Per Week : **03**
Periods Per Semester : **45**

Biomedical Instrumentation lab Practice

S.No.	Major Topics	Periods
1	Transducers	21
2	Electrodes & amplifiers	18
3	Biomedical recorders	6
	Total	45

List of the Experiments

1. To perform an experiment to demonstrate the working of capacitive transducer
2. To perform an experiment to demonstrate the working of Piezo electric transducer
3. To measure the strain gauge factor using Strain gauge transducer
4. To obtain the relationship between resistance and temperature using RTD
5. To obtain the characteristics of Thermistors
6. To perform an experiment to demonstrate the working of Thermocouple
7. To perform an experiment to demonstrate the working of potentiometric transducer
8. To obtain characteristics of LVDT
9. To perform an experiment to demonstrate the working of Photo transducer
10. To measure Half-cell potential.
11. To measure off-set potential
12. To demonstrate the working of different bio electrodes
13. To verify the operation and obtain output voltage of differential amplifier
14. To verify the operation and obtain voltage gain of instrumentation amplifier
15. To record ECG waveform using ECG Recorder
16. To perform an experiment to demonstrate the working of digital CRO

Exp No	Name of the Experiment	Objectives	Key competencies
1	Capacitive transducer	<ol style="list-style-type: none"> 1. Know the principle of capacitive transducer 2. Make the circuit connections 3. Identify the capacitive transducer 4. To identify different modules 5. Know the variations of output signal w.r.t variations in 'd' 'a'. 	<ol style="list-style-type: none"> 1. Performs the experiment as per the procedure 2. Noting down the observations 3. Draws inferences
2	Piezoelectric transducer	<ol style="list-style-type: none"> 1. Identify the suitable transducer 2. Make the circuit connections 3. Know the principle of piezoelectric transducer 4. Know about piezoelectric materials 	<ol style="list-style-type: none"> 1. Performs the experiment as per the procedure 2. Noting down the observations 3. Draws inferences 4. Record variations in output voltage w.r.t change in external force
3	Strain gauge transducer	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Observe the variations in resistance w.r.t various weights 5. Know the linearity between weights & strain 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Measure the percentage of linearity 4. Plot the graph between weights & strain 5. Calculate the gauge factor

4	Characteristics of RTD	<ol style="list-style-type: none"> 1. To identify various modules 2. Know the principle 3. Make the circuit connections 4. Know the variations in resistance with various input temperatures 5. Convert temperature in °C to kelvins 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Plot the graph between R&T 4. Draws inferences
5	Thermistors	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Know the variations in resistance with various input temperatures 5. Know the principle of NTC 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Plot the graph between R&T 4. Draws inferences
6	Characteristics of thermocouple	<ol style="list-style-type: none"> 1. To identify various modules 2. Know the principle 3. Make the circuit connections 4. To maintain different temperatures at two different junctions 5. Know about the dissimilar materials used 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Record the variation in output voltage w.r.t change in junction temperatures 4. Plot graph between temperature difference & output voltage

7	Potentiometric transducer	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Know the change in output voltage with change in resistance 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Plot the characteristics between resistance and temperature 4. Draws inferences
8	LVDT	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Note down the constructional details & specifications 5. Know the no.of secondary windings and their inter connection 6. Identify null voltage and know it's significance 7. Observe the linear variation of the graph on either side of null point 	<ol style="list-style-type: none"> 1. Perform the experiment as per the procedure 2. Note down the observations 3. Plot the characteristics between displacement and voltage
9	Photo transducer	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Observe the change in output voltage ,current, w.r.t variation in input light 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Plot the characteristics between output voltage ,current w.r.t change in input light 4. Draws inferences

10	Measurement of Half cell potential	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Know about halfcell potentials of various electrodes 5. Preparation of electrolyte solution 6. Measure output voltage between electrode & electrolyte solution using DMM 	<ol style="list-style-type: none"> 1. Measure the half cell potential for various electrodes 2. Preparation of report
11	Measurement of off-set potential	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Make the circuit connections 4. Preparation of electrolyte solution 5. Measure output voltage between two electrodes using DMM 6. Minimization of off-set with two similar electrodes 	<ol style="list-style-type: none"> 1. Measure the half-cell potential for various electrodes 2. Minimize off-set voltage by using two similar electrodes 3. Report Preparation
12	Study of different bio electrodes	<ol style="list-style-type: none"> 1. Identify various electrodes available 2. Applications of various electrodes 3. Maintenance of electrodes 	<ol style="list-style-type: none"> 1. Identify the application of each electrode 2. Mount the electrode in correct location

13	Differential amplifier	<ol style="list-style-type: none"> 1. Identify the circuit 2. Know the equation for output voltage 3. Make the circuit connections 4. Vary input voltages using potentiometer V_a & V_b 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Measure the output voltage for different inputs using DMM 4. Compare theoretical & practical voltages
14	Instrumentation amplifier	<ol style="list-style-type: none"> 1. Identify the circuit 2. Know the equation for output voltage 3. Make the circuit connections 4. Vary input voltages using potentiometer V_a & V_b 5. Make out the differences between differential & instrumentation amplifier 	<ol style="list-style-type: none"> 1. Perform experiment as per the procedure 2. Note down the observations 3. Measure the output voltage and overall gain for different inputs using DMM 4. Compare theoretical & practical voltages
15	Measurement of ECG using ECG recorder	<ol style="list-style-type: none"> 1. Identify the type of recorder 2. Observe the front panel controls 3. Know the principle of ECG recorder 4. Load the ECG roll paper into machine 5. Stylus adjustment 6. Calibration 7. Connect the patient electrode probe 8. Identify various lead configuration 	<ol style="list-style-type: none"> 1. Record the ECG from various leads as per the procedure 2. Identify various ECG parameters in ECG waveform 3. Report preparation

16	Digital CRO	<ol style="list-style-type: none"> 1. Identify the front panel controls 2. Observe the variation in frequency by varying the time period 3. Observe the variation in amplitude by varying the voltage 4. Calculate the frequency & amplitude of output signal 	<ol style="list-style-type: none"> 1. Measure the output signal parameters by using CRO 2. Identify the difference between conventional & digital CRO
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V SEMESTER

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION
FIFTH SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination				
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks	
BM-501	Computer Networks	5	--	75	3	20	80	100	
BM-502	Measurement & Test Equipment	5	--	75	3	20	80	100	
BM-503	Bio-Medical Equipment	5	--	75	3	20	80	100	
BM-504	Analytical Instrumentation Engineering	5	--	75	3	20	80	100	
BM-505	Medical Implants Engineering	5	--	75	3	20	80	100	
BM-506	Medical Informatics & Telemedicine	5	--	75	3	20	80	100	
BM-507	Measurement & Test Equipment Lab Practice	--	3	45	3	40	60	100	
BM-508	Life Skills	--	3	45	3	40	60	100	
BM-509	Computer Hardware & Networking Lab Practice	--	3	45	3	40	60	100	
BM-510	Analytical Instrumentation Lab Practice	--	3	45	3	40	60	100	
		30	12	630	27	280	720	1000	

COMPUTER NETWORKS

Subject Title	:	Computer Networks
Subject Code	:	BM - 501
No. of period/week	:	05
No. of period/year	:	75

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weight age of marks	Short type	Essay Type
1.	Introduction to computer networks.	12	16	2	1
2.	Data link Layer and MAC Sublayer	15	26	2	2
3.	Network layer and Transport Layer	15	26	2	2
4.	Application Layer and Network security	13	16	2	1
5.	Wireless communication technology and Wireless LANs	20	26	2	2
	Total	75	110	10	8

OBJECTIVES

On completion of the course a student will be able to:

1.0 Introduction to Data communication and networking

- 1.1 Explain communication model.
- 1.2 Explain data communication, transmission impairments and channel capacity.
- 1.3 State the Need for Networking.
- 1.4 Classification of Networks –LAN, MAN, WAN

- 1.5 List the Network Hardware and Software Components.
- 1.6 Explain the Overview of Network Topologies.
- 1.7 Basic Topologies such as Bus, Ring, Star and Hybrid
- 1.8 Discuss Various Network Communication Standards.
- 1.9 Explain OSI Reference Model and TCP IP model
- 1.10 Explain Inter layer Communication – Data Encapsulation, Horizontal Communication, Vertical Communication, Encapsulation
- 1.12 Know about LAN Cables and Connectors, NIC,wireless network adapter
- 1.13 Know about Coaxial Cables, Twisted-Pair Cables, Optical Fiber Cables, and Connectors.
- 1.14 State function of LAN Devices : Repeaters, Hubs, Switches, Network Interface Cards (NICs), Routers (CISCO, DAX, Etc.), Modem (64KBPS Internal or External, ADSL Modems,Etc.)
- 1.15 Discuss internet, X .25, frame relay and ATM

2.0 Data Link Layer and MAC Sublayer

- 2.1 Explain the design issues of data link layer: services provided to network layer framing, error control and flow control.
- 2.2 List elementary data link protocols.
- 2.3 Explain the concept of unrestricted simplex protocol.
- 2.4 Explain the concept of simplex stop and wait protocol.
- 2.5 Explain the concept of protocol for noisy channel.
- 2.6 Explain the concept of Sliding window protocol.
- 2.7 Explain the concept of one bit sliding window protocol.
- 2.8 Explain the concept of GO BACK N protocol.
- 2.9 Explain the concept of selective repeat protocol.
- 2.10 Know most widely used data link protocols.
- 2.11 Explain the concept of HDLC.
- 2.12 Explain data link layer in the internet.
- 2.13 Discuss static and dynamic channel allocation in LANs and MANs.
- 2.14 Explain Ethernet.
- 2.15 Explain the concept of Ethernet MAC protocol
- 2.16 Explain switched Ethernet, fast Ethernet and gigabit Ethernet

2.17 Know IEEE 802 standards

2.18 Explain 802.2 LLC

3.0 The Network and Transport layer .

3.1 Explain Network layer design issues.

3.2 Explain services provided to the transport layer.

3.3 Explain the concept of store and forward packet switching.

3.4 Explain connection less services and connection oriented services.

3.5 Compare virtual circuits and datagram subnets.

3.6 List various Routing algorithms.

3.7 Explain the concept of Shortest path routing,

3.8 Discuss congestion control and prevention.

3.9 Explain the role of Network layer in the internet.

3.10 Explain IP addressing and classes with examples

3.11 Explain IPV4 and subnetting.

3.12 Explain mobile IP.

3.13 Explain and state features of IPV6 .

3.14 Explain the transport layer services.

3.15 Explain services provided to upper layers.

3.16 Explain elements of transport protocols.

3.17 Understand the concept of connection establishment and release.

3.18 Explain flow control and buffering.

3.19 Explain multiplexing.

3.20 Internet transport protocol.

3.21 Explain UDP.

3.22 Explain the concept of remote procedure calls.

3.23 Internet transport protocol: TCP.

3.24 Explain TCP service model.

3.25 Explain TCP connection establishment and release.

3.26 Explain wireless TCP and UDP.

4.0 The Application layer and Network security.

- 4.1 List the functions of telnet, FTP, HTTP, e-mail.
- 4.2 Explain web access using http
- 4.3 Explain DNS.
- 4.4 Explain VOIP and multimedia service.
- 4.5 Know components of WWW.
- 4.6 Explain N-ISDN, B-ISDN and ADSL.
- 4.7 Know importance of Network security and Security services
- 4.8 Explain security attacks
- 4.9 Explain cryptography.
- 4.10 Explain substitution ciphers.
- 4.11 Explain transposition ciphers.
- 4.12 Explain concepts of message authentication and hash functions.
- 4.13 Explain concepts of private and public key encryption
- 4.14 Explain concepts of digital signatures.
- 4.15 Explain concepts of secure socket layer and transport layer security.
- 4.16 Explain concepts of IPV4 and IPV6 security.

5.0 Wireless communication technology and LANs.

- 5.1 Explain the concept of Spread spectrum.
- 5.2 Explain the concepts of frequency hopping, spread spectrum.
- 5.3 Explain the concepts of direct sequence spread spectrum.
- 5.4 Explain code division multiple access.
- 5.5 Explain the concepts of Wireless networking.
- 5.6 Explain satellite parameters and configurations.
- 5.7 Explain capacity allocation, frequency division and time division.
- 5.8 Introduction to cellular networks.
- 5.9 Explain 1G, 2G ,3G and 4G cellular systems.
- 5.10 Explain mobile IP and WAP.
- 5.11 Over view on Wireless LAN technology.
- 5.12 Explain infrared LANs.
- 5.13 Explain spread spectrum LANs.

- 5.14 Explain narrow band spread spectrum LANs.
- 5.15 IEEE 802.11 wireless LAN standards.
- 5.16 Explain IEEE 802.11 architecture and services.
- 5.17 Explain IEEE 8002.11 MAC.
- 5.18 Explain IEEE .11 physical layer.
- 5.19 Over view on Blue tooth.
- 5.20 Explain base band specification.
- 5.21 Explain link manager specification.
- 5.22 Explain the concepts of logic link control protocol.
- 5.23 List blue tooth applications.

COURSE CONTENT:

1 Introduction to Data communication and networking:

Communication model, data communication, transmission impairment channel capacity, networking. OSI and TCP/IP models, LANs, MANs, WANs, internet, X .25, frame relay and ATM

2 The data link layer and MAC Sub layer

Design issues of data link layer, services provided, framing , error and flow control, protocols, simplex, stop and wait protocol, noisy channel, Sliding window protocol , GO BACK N selective repeat protocol, HDLC, static and dynamic channel allocation, Know IEEE 802 standards

3 The Network and Transport layer.

Design issues, packet switching, virtual. circuits and datagram subnets, Routing algorithms, optimality principle, congestion control, the internet, IP address, multicasting, IPV 6, UDP, TCP service model. wireless TCP and UDP.

4 The Application layer and Network security.

Telnet, FTP, e-mail, HTTP, DNS, VOIP and multimedia service. N-ISDN, B-ISDN and ADSL, cryptography, substitution & transposition ciphers, message authentication, public key encryption and digital signatures, IPV6 and IPV6 security.

5 Wireless communication technology and LANs.

Spread spectrum, frequency hopping, spread spectrum, direct sequence spread spectrum, CDMA, Wireless networking, satellite Parameters and configurations, capacity allocation, FD & TD, Cellular networks (1G, 2G, 3G and 4G), mobile IP and WAP, Wireless LAN, technology, infrared, spread spectrum, narrow band spread spectrum LANs AND IEEE 802.11 wireless LAN standards, Blue tooth, radio specification, base band, link manager specification, logic link control protocol.

REFERENCE BOOKS:

1. Computer networks By Tannen Baum
2. Data Communication and Computer networks – William Stallings
Local Area Networks Basendra

TEXT BOOKS

1. Wireless communication and networking by William Stallings. PHI.
2. Computer networking with internet protocols and technology by William Stallings. Pearson education.
3. Computer Communications & Networking technologies by Michael A.Gallo, William M.Horrcock, Thompson Learning

MEASUREMENTS AND TEST EQUIPMENT

Subject Title	:	Measurements and Test Equipment
Subject Code	:	BM-502
Periods/Week	:	05
Periods/Semester	:	75

TIME SCHEDULE WITH BLUE PRINT

S. No	Major Topics	No. of periods	Weightage of Marks	Short type	Essay type
1	Basics of Measurement and instrumentation	08	13	1	1
2	Analog instruments	20	26	2	2
3	Digital instruments	10	16	2	1
4	Cathode Ray Oscilloscope	10	16	2	1
5	Signal generators	15	21	2	1 1/2
6	Test Instruments	12	18	1	1 1/2
	Total	75	110	10	8

OBJECTIVES

On completion of the study of the subject a student should be able to comprehend the following:

- 1.0 **Understand the purpose of measurement and instrumentation.**
- 1.1 Define measurement.
- 1.2 Classify the methods of measurements.
- 1.3 List the factors in selection of measuring instruments.
- 1.4 Explain the performance characteristics - a) Calibration, b) accuracy, c) precision, d) repeatability, e) reproducibility, f) Drift, g) sensitivity, h) resolution, i) Dead zone, J) backlash, k) true value, l) hysteresis.

2.0 Understand the working of Analog instruments.

- 2.1 Explain the construction and principle of operation of PMMC meters.
- 2.2 List Explain the principle of extending the range of DC ammeter and Dc voltmeter.
- 2.3 List the advantages of using the Ayrton Shunt (Universal) with an example.
- 2.4 Explain the Conversion of Ammeter to Voltmeter
- 2.5 Explain the Conversion of Voltmeter to Ammeter
- 2.6 Define sensitivity of voltmeter.
- 2.7 Explain loading of volt meter with an example.
- 2.8 List the precautions to be taken while using an ammeter and voltmeter.
- 2.9 Explain construction and principle of series and shunt type Ohm meters
- 2.10 Explain the principle and working rectifier type AC voltmeter.
- 2.11 Explain the circuits of DC/AC voltmeter, DC/AC ammeter and resistance measurement sections of a multimeter.
- 2.12 Explain the working principle of FET input electronic voltmeter.
- 2.13 Explain differential Voltmeter with necessary circuit.
- 2.14 Explain the operation of Wheat Stone Bridge and list its applications.
- 2.15 Explain the operation of Kelvin Bridge and list its advantages over Wheatstone bridge.
- 2.16 Explain the inductance measurement using Maxwell's Bridge and Hay's bridge and compare.
- 2.17 Explain the capacitance measurement using Schering Bridge.

3.0 Understand working of Digital instruments.

- 3.1 List the advantages of digital instruments over analog instruments.
- 3.2 Define terms Resolution, Settling time, Propagation Delay.
- 3.3 Explain Ramp type Digital Voltmeter with block diagram
- 3.4 Explain dual slope integrating type digital voltmeters with block diagram
- 3.5 List the specifications of digital voltmeters.
- 3.6 Explain the working of Digital Multimeter with block diagram and list its specifications.
- 3.7 Explain the working of Digital capacitance meter.

- 3.8 Explain the working of digital LCR meter with block diagram
- 3.9 List the specifications of digital LCR meter.
- 3.10 Explain the principle of digital tachometer and digital PH meter.

4.0 Understand construction, working principle and use of CRO

- 4.1 Sketch the block diagram of general purpose CRO and describe the function of each block.
- 4.2 Sketch CRT and describe the function of different parts.
- 4.3 List different focussing techniques and compare them.
- 4.4 Write the expression for deflection sensitivity.
- 4.5 Explain vertical deflection system with block diagram.
- 4.6 Explain the horizontal deflection system and the necessity of time base.
- 4.7 List the conditions for stationary waveforms.
- 4.8 Identify the function and use of various controls and terminals of CRO.
- 4.9 List the specifications of CRO.
- 4.10 Explain the principle of Dual beam CRO.

5.0 Understand the construction, working principle of AF, RF signal generators and power meter

- 5.1 Explain the working of AF Oscillator (sine & square) with operational amplifier (Wein Bridge).
- 5.2 List the front panel controls and specifications of AF Oscillator.
- 5.3 Explain the principle of beat frequency oscillator.
- 5.4 Explain the working of function generator with operational amp. Integrator and differentiator.
- 5.5 List the front panel controls and specifications of Function generator.
- 5.6 List the applications of AF oscillators and function generators.
- 5.7 Explain the block diagram of a pulse generator.
- 5.8 Give the principle of energy measurement
- 5.9 Explain the working of AF power meter.
- 5.10 Explain the working of bolometer type RF power meters.
- 5.11 List the applications of power meters.

6.0 Understand the construction and working of test instruments

- 6.1 Explain the method of testing passive and active components (diode, transistor) using multimeter.
- 6.2 Explain the method of measuring leakage current, alpha, beta of a transistor using transistor tester.
- 6.3 Explain the set up for displaying the characteristics of Transistor using Curve tracer.
- 6.4 Explain the Block diagram and operation of spectrum analyzer.
- 6.5 Explain the construction & working of Q-meter.
- 6.6 Discuss the necessity of Logic probe and its applications.
- 6.7 Explain how the digital ICs can be tested with digital IC tester
- 6.8 Explain the working of Logic Analyser with block diagram.
- 6.9 State the necessity of plotter and recorders.
- 6.10 Explain the working of XY recorders.
- 6.11 Explain the working of plotter.

COURSE CONTENTS

1. Basics of Measurements and Instrumentation

Definition of measurement and instrumentation, performance characteristics, classification,

2. Analog instruments:

PMMC Instrument, extending the range of ammeter and voltmeter, sensitivity, Loading of voltmeter, series and shunt type ohmmeter, ac measuring with meters, Multimeter, Electronic voltmeter, differential voltmeter, Wheatstone, Kelvin, Maxwell Hay and Schering Bridges.

3. Digital Instruments:

Digital voltmeter: Dual slope integrating type, resolution and sensitivity of Digital instruments. Multimeter, Specifications, Digital Capacitance meter, Digital LCR Meter, Working principle of Digital tachometer and PH meters,

4. Cathode Ray Oscilloscope:

Block diagram of CRO, parts of CRT, Deflection Sensitivity, vertical and horizontal deflection systems, delay line, controls, specifications, applications, Dual Beam CRO

5. Signal Generators & Power meters

AF oscillator, Beat Frequency Oscillator, function generator, Pulse generator, specifications, AF and RF power meters

6. Test instruments:

Testing of components with Multimeter, Transistor tester, Curve Tracer, Digital Spectrum analyser, Logic Probe, Digital IC tester, Logic analyser, Q meter, plotters and recorders

REFERENCES

1. Electronic instrumentation and measurements by David A Bell, PHI
2. Electronic Instrumentation by H S Khalsi, TMH
3. Modern Electronic Instrumentation and Measurement Techniques -William D Cooper
Electronic measurements by A K Shaurky
4. Electronic Measurements & Instruments by Cooper, PHI
5. Modern Electronic Equipment by Khandpur
6. Electrical, Electronic Measurements and Instruments by Sahney
7. Electronic Measuring Instruments Gupta, TMH

BIOMEDICAL EQUIPMENT

Subject Title	:	Biomedical Equipment
Subject Code	:	BM –503
Periods Per Week	:	05
Periods Per Semester	:	75

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of marks	Short type	Essay type
1	Cardiac Instrumentation	18	29	3	2
2	Neuro-Muscular Instrumentation	15	23	1	2
3	Phonocardiography & Pace maker	18	26	2	2
4	Defibrillators	12	16	2	1
5	Respiratory and Anesthesia	12	16	2	1
	TOTAL	75	110	10	8

OBJECTIVES

On completion of this subject student will learn:

1. Principal & Working of Cardiac Instrumentation

- 1.1 Draw Typical ECG wave form and write its parameters
- 1.2 Explain the Correlation of the electrical activity of the heart with its mechanical activities
- 1.3 Explain Various lead configurations used in ECG recording
- 1.4 Explain Block diagram of an ECG machine

- 1.5 Explain different Types of ECG recorders – single channel, Three channel stress – testing and Holter monitor
- 1.6 List the sources of noises in ECG recording
- 1.7 Explain the minimization of noise in ECG recording.
- 1.8 List the Typical specifications of an ECG machines
- 1.9 Explain the Concept of continuous patient monitoring
- 1.10 Explain the Block diagram of a Bed side monitor and the central monitoring station
- 1.11 List the Critical parameters monitored in ICCU
- 1.12 List the normal ranges of blood pressure in the basic circulatory system
- 1.13 Explain the Principles of direct techniques of blood pressure measurement
- 1.14 Explain the Principles of and indirect techniques of blood pressure measurement using korotkoff sounds

2 Operation of Neruro-Muscular Instrumentaion

- 2.1 List different EEG waveforms and mention their characteristics.
- 2.2 Explain the working principle of EEG machine with a neat block diagram.
- 2.3 Name various controls in an EEG machine
- 2.4 List the requirements of an EEG amplifier
- 2.5 Explain the 10-20 system of EEG electrode placement.
- 2.6 List different electrodes used in EEG recording.
- 2.7 Explain different sleep stages with waveforms.
- 2.8 Explain the block diagram of an EMG recording system
- 2.9 List the electrodes used in EMG recording
- 2.10 Explain the procedure for nerve conduction velocity determination and give its significance.
- 2.11 Explain the principle of nerve muscle stimulator with block diagram.
- 2.12 List types of waves forms used in nerve muscle stimulator & mention their applications.

3 Operation of Phonocardiography & Pacemaker

- 3.1 List various heart sounds & mention their origin
- 3.2 Explain the Characteristics of all heart sound
- 3.3 State the Need for phonocardiography
- 3.4 Explain the block diagram of Phonocardiography
- 3.5 State the Need for a cardiac pacemaker
- 3.6 Classify pacemakers on various aspects
- 3.7 Explain the Block diagram of an Asynchronous pacemaker
- 3.8 Explain the block diagram of demand and atrial synchronous pacemaker.
- 3.9 List the Advantages of Synchronous pacemakers over Asynchronous pacemaker
- 3.10 Explain the Block diagram of a Rate Responsive pacemaker
- 3.11 List the Power supplies used in external & internal pacemakers
- 3.12 List the types of electrodes and leads used in pacemakers

4 Principle of various defibrillators

- 4.1 State the Need for a defibrillator
- 4.2 Classify defibrillators
- 4.3 Compare external & internal defibrillators
- 4.4 Explain the Circuit diagram of AC defibrillator
- 4.5 List the advantages of DC defibrillators over AC defibrillators
- 4.6 Explain the Circuit diagram of capacitive discharge DC defibrillator
- 4.7 Explain the Circuit diagram of delay line capacitive discharge defibrillator
- 4.8 Give the Need for synchronization of defibrillator shock
- 4.9 Explain the Block diagram of a cardioverter
- 4.10 List the types of electrodes used in external & internal defibrillators
- 4.11 Explain the types of electrodes used in external & internal defibrillators with diagram
- 4.12 List the Precautions to be taken while handling defibrillators
- 4.13 Explain defibrillator analyzer.

5. Appraise the working principle of respiratory and Anesthesia equipment.

- 5.1 Give the need for a ventilators,
- 5.2 Classify ventilators.
- 5.3 Explain the principle of various types of ventilators– pressure limited, volume limited, positive pressure, negative pressure.
- 5.4 List the types of cycling in ventilators.
- 5.5 Draw and explain the block diagram of Micro Processor based ventilator.
- 5.6 State the importance of Anesthesia.
- 5.7 List the functions of a Boyle's machine.
- 5.8 Explain the operation of Boyle's machine with diagram.
- 5.9 Explain centralized Gas distribution system
- 5.10 Mention the colour code for pipes and cylinders used for distribution and storage of gases.

COURSE CONTENTS

- 1. Cardiac Instrumentation and Patient Monitoring:** Basis of ECG, typical ECG waveform, 12 – lead ECG, block schematic of ECG machine, ECG amplifier circuits, special types of ECG recorders, Noise ;and their elimination in ECG recording IICCU organization, Block diagram of bed side monitor, critical physiological parameters to be monitored Techniques for direct and indirect B.P. measurement
- 2. Neuro-Muscular Instrumentation:** EEG Basics of EEG, block schematic of EEG machine, 10 – 20 electrode placement, resting rhythms and sleep stages.EMG Block diagram of EMG recording system types of electrodes used, instrumentation for measurement of nerve condition velocity.
- 3. Phonocardiography & pacemakers:** Origin of heart sounds, Phonocardiographic instrumentation. Classification of pacemakers, Block diagrams of various types of pacemakers asynchronous, synchronous (demand and atrial – synchronous) and power supplies and electrodes used in pacemakers

4. **Defibrillators:** Circuit diagrams of AC, capacitive discharge and delay line capacitive discharge defibrillators. Types of electrodes Need for synchronization block diagram of cardioverter testing and safety

5. **respiratory and Anesthesia equipment.:** Need for ventilators, types, boyles machine, centralized gas distribution

REFERENCE BOOKS

1. Medical Instrumentation Application & Design John G Webster
(Houghton Mifflin Company)
2. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur
(Tata Mc. Graw Hill)
3. Introduction to Biomedical equipment Technology – Carr & Brown (John Willey & sons, Newyork – 1981)
4. Encyclopedia of Medical devices & Instrumentation - Vo I,II,III, & IV Editor John G. Webster
5. Biomedical Engg. Principles David O. Cooney

ANALYTICAL INSTRUMENTATION ENGINEERING

Subject title : Analytical Instrumentation Engineering
Subject Code : BM-504
Periods Per Week : 05
Periods Per Semester : 75

TIME SCHEDULE

Sl.No.	Major Topics	<u>No.of Periods</u>	Weightage of marks	Short type	Essay type
1	Introduction to analytical Instrumentation	10	13	1	1
2	Comprehend the concept of colorimeter & spectrophotometer	18	26	2	2
3	Comprehend the concept of Flame photometer, Chromatograph, Electrophoresis	15	26	2	2
4	Introduction to radio chemical and biochemical instruments	12	16	2	1
5	Comprehend the principles of conductivity meter, p H meter , and Blood gas analyzer	20	29	3	2
	TOTAL	75	110	10	8

OBJECTIVES

Understand the analytical instrumentation

- 1.1. Draw and explain block diagram of Analytic instrumentation.
- 1.2 Explain the use of personal computers in analytical instruments
- 1.3 Draw and explain Electromagnetic spectrum.
- 1.4 Explain Beer Lamberts law.
- 1.5 Explain Monochromator (Prism and Grating)
- 1.6 List the different types of Visible, UV and IR light sources.
- 1.7 List the different types of Visible, UV and IR light Detectors
- 1.8 Explain principle of operation, description and applications of the following:
 - a) Single beam Visible/U.V Spectrophotometer meter
 - b) IR Spectrophotometer.

2.0 Analyze the concept of colorimeter & spectrophotometer

- 2.1 Explain the working principle of colorimeters
- 2.2 Explain the basic components of a single beam & double beam photometer
- 2.3 Explain the basic principle of spectrophotometer
- 2.4 Compare radiation energy from a colour filter and Monochromator
- 2.5 Explain the working of single beam Null-type spectrophotometer
- 2.6 Explain the working principle of direct reading spectrophotometers/spectrophotometers
- 2.7 Employ microprocessor control spectrophotometer
- 2.8 State the Need of digital spectroscopy
- 2.9 List the Sources of error in spectrophotometric measurements
- 2.10 Need for calibration in spectrophotometer

3.0. Analyze the concept of Flame photometer, Chromatograph, Electrophoresis

- 3.1 Explain the principle of flame photometry
- 3.2 Explain the Constructional details of flame photometers
- 3.3 Explain basic principle of flame photometer with block diagram
- 3.4 Explain the interferences in flame photometry
- 3.5 Explain Measurement of fluorescence
- 3.6 Explain Block diagram of typical fluorimeter
- 3.7 Explain the Basic principle of chromatography & different types
- 3.8 Explain Block diagram of a gas chromatograph
- 3.9 Explain the methods of measurement of peak areas
- 3.10 Explain Block diagram of liquid chromatograph
- 3.11 Explain the Principle and different techniques of electrophoresis
- 3.12 Explain about complete electrophoresis apparatus
- 3.13 State the Need of densitometer in electrophoresis
- 3.14 Apply Microprocessors in densitometer

4.0 Understand radio chemical and biochemical instruments

- 4.1 Know the fundamentals of radiochemical instruments
- 4.2 State the Principle of radiation detectors
- 4.3 Explain Block diagram of a pulse height analyzer
- 4.4 Explain the Basic principle of X-ray spectrometers
- 4.5 Explain the instrumentation for X-ray spectrometer
- 4.6 Explain Principle of automated biochemical analysis system
- 4.7 List of component steps in automated system
- 4.8 Explain the schematic diagram of a continuous flow system
- 4.9 Explain system components
- 4.10 Analyze and know the applications automated biochemical analysis system

5. Understand the principles of conductivity meter, pH meter, and Blood gas analyzer

- 5.1 Explain Principle of measurement of conductance
- 5.2 Explain conductivity meter with block diagram
- 5.3 Define pH
- 5.4 Explain the Principle of pH measurement
- 5.5 Explain different electrodes for pH measurement
- 5.6 Explain working principle of pH meter with block diagram
- 5.7 Explain the Null –detector type pH meter
- 5.8 Explain Chopper amplifier type pH meter
- 5.2 Explain digital pH meter with block diagram
- 5.3 Explain the principle of Biosensors
- 5.4 Explain what is blood gas analyzer
- 5.5 Explain catheter tip electrode for measurement of pO₂ and pCO₂
- 5.6 Explain complete blood gas analyzer with block diagram

COURSE CONTENTS:

- 1.0 Introduction to analytical instrumentation:** block diagram of analytical instrumentation, electromagnetic spectrum Beer Lambert's law, Monochromator, different types of visible, UV, IR light detectors, U.V Spectrophotometer meter

- 2.0 Comprehend the concept of colorimeter & spectrophotometer:** principle of colorimeter, **single** beam & double beam photometer, spectrophotometer, colour filter and Monochromator, Null-type spectrophotometer, direct reading spectro-colorimeters/spectrophotometers

- 3.0 Comprehend the concept of Flame photometer, Chromatograph, Electrophoresis:**
principle of flame photometry, interferences in flame photometry, Measurement of fluorescence, fluorimeter, gas chromatograph, liquid chromatography, complete electrophoresis, densitometer

4.0 Introduction to radio chemical and biochemical instruments :

Fundamentals of radiochemical instruments, radiation detectors, pulse height analyzer, X-ray spectrometers, automated biochemical analysis system, applications of automated biochemical analysis system

5.0 Comprehend the principles of conductivity meter, p H meter , and Blood gas analyzer :

Principle of measurement of conductance, conductivity meter, p H measurement , p H meter, Null –detector type p H meter, Chopper amplifier type p H meter, digital p H meter, Biosensors, blood gas analyzer

TEXT BOOKS

1. Medical Instrumentation – Application & Design John G. Webster
Houghton Mifflin Company
2. Handbook of Biomedical Instrumentation R.S. Khandpur Tata Mc Graw Hill.

REFERENCE BOOKS

1. Handbook of Analytical Instruments R.S. Khandpur Tata Mc Graw Hill

MEDICAL IMPLANTS ENGINEERING

Subject Title : **Medical Implants Engineering**
Subject Code : **BM– 505**
Periods per Week : **05**
Periods per Semester : **75**

TIME SCHEDULE

Sl.No.	Major Topics	Periods	Weightage of marks	Short type	Essay type
1.	Bio Compatibility	12	26	2	2
2.	Biomaterials	20	26	2	2
3.	Orthopedic Implants	20	29	3	2
4.	Cardiac & Muscular implants	15	16	2	1
5.	Cochlear Implants	08	13	1	1
	TOTAL	75	110	10	08

OBJECTIVES:

I Discuss about the Bio compatibility

- 1.1 Define Bio Compatibility
- 1.2 Explain the significance of Bio Compatibility
- 1.3 Explain the wound - Healing process
- 1.4 Explain the tissue Response to Implants
- 1.5 Explain the Systemic effects of Implants
- 1.6 Explain the factors effecting Bio Compatibility
- 1.7 Explain In vitro testing (Mechanical testing) of implants, tensile, compression, wears, fatigue, corrosion studies and fracture toughness.
- 1.8 Explain the In-vivo testing (animals): biological performance of implants

II. Differentiate the types of Bio Materials

- 2.1 Define Bio Material
- 2.2 Classification of biomaterials

- 2.3 Explain surface properties, mechanical properties of materials
- 2.4 Explain metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys
- 2.5 Examine importance of stress-corrosion cracking
- 2.6 Explain polymeric implant materials: Polyolefin's, polyamides, acrylic polymers, hydro gels, and Silicon rubbers
- 2.7 Define bio ceramics.
- 2.8 List the types of bio ceramic materials
- 2.9 Explain Bio reabsorbable and bioactive ceramics.
- 2.10 Explain the Importance of wear resistance and low fracture toughness
- 2.11 Composite implant materials: Mechanics of improvement of properties by incorporating different elements
- 2.12 List applications of different Biomaterial
- 2.13 Compare characteristics of various Bio Materials

III. Demonstrate the Orthopedic Implants

- 3.1 Explain Hard Tissue Replacement implants techniques.
- 3.2 Explain internal fracture Fixation devices
- 3.3 Explain orthopedic fixation devices
- 3.4 Explain about Bone cement.
- 3.5 Differentiate cemented and uncemented joints
- 3.5 Explain permanent joint replacement.
- 3.6 Explain about total Hip, Knee, Ankle, Shoulder, Elbow and wrist Joint replacements.
- 3.7 List the problems with orthopedic implants
- 3.8 Explain the safety precautions to be taken with orthopedic Implants

IV. Examine the Cardiac and Muscular Implants

- 4.1 List the types of tissue grafts
- 4.2 Explain vascular implants, blood compatibility of synthetic vascular material, synthetic blood vessels, biological grafts
- 4.3 Explain the need for artificial heart valve

- 4.4 Explain the types of artificial heart valves
- 4.5 State the need for implantable pacemaker
- 4.6 Explain the programmable internal pacemaker
- 4.7 Explain the batteries used in internal pacemakers
- 4.8 State the need of implantable defibrillator
- 4.9 Describe the block diagram of implantable defibrillator
- 4.10 List the safety precautions to be taken with defibrillators
- 4.11 Explain the operation of drop - foot stimulator.
- 4.12 Explain bladder stimulator.
- 4.13 Describe the electric hand and its applications
- 4.14 Explain the artificial arm prosthesis

V. Examine the Cochlear and eye implants

- 5.1 State the Need for cochlear implants.
- 5.2 Explain the cochlear implants in detail.
- 5.3 Explain about contact lenses, intra ocular lenses, vitrous implants, eye shields
- 5.4 Explain the safety precaution to be taken for the above.

COURSE CONTENTS

Bio Compatibility

Definition and significance of biocompatibility, factors influencing bio compatibility.

2. Biomaterials

Describable characteristics of a material to be used in the manufacture of various medical implants, types of materials used as biomaterials – Metals, Polymers, Ceramics and composite materials, characteristics and application of different biomaterials, comparison of various biomaterials.

3. Orthopaedic implants

Orthopedic fixation devices, Bone cement; Permanent joint replacement – Hip, Knee, ankle, shoulder, elbow and wrist; manufacturing process of orthopedic implants; problems with orthopedic implants and safety precautions

4. Cardiac and Muscular implants:

Implant able pacemakers, implant able defibrillators and prosthetic heart valves
Operation of drop-foot stimulator, bladder stimulator, my electric hand and arm prosthesis.

5. Cochlear implants:

Need and Operation of a cochlear and eye implant.

Test books

C.P.Sharma & M.Szycher, *Blood compatible materials and devices*, Technomic Publishing Co. Ltd., 1991.

Sujata V. Bhat, *Biomaterials*, Narosa Publishing House, 2002

REFERENCE BOOKS

1. Hand book of Biomedical Engineering - Joseph D. Bronzino (CRC press)
2. Encyclopedia of Medical Devices and Instrumentation - (Vol I, II, III, IV) John G Webster
3. Biomaterials – An interfacial approach - Hench Ethridhe
4. Medical Instrumentation Application and design John G. Webster (Houghton Mifflin Company)
5. Biomaterials Science and Engg.-Joon Bupark.
6. Encyclopedia Hand Book of Biomaterials and Bio Engg.Vol 1 to 4.

MEDICAL INFORMATICS & TELEMEDICNE

Subject Title : Medical Informatics & Telemedicine

Subject Code : BM –506

Periods Per Week : 05

Periods per Semester : 75

TIME SCHEDULE

SI No.	Major topics	No of periods	Weightage of marks	Short Ques (S)	Essay Ques (E)
1	Medical Informatics & Artificial Intelligence	15	21	2	1.5
2	Computer-Assisted Instructions	15	26	2	2
3	Computer-Assisted Surgery	18	24	3	1.5
4	Telemedicine	15	21	2	1.5
5	Telesurgery	12	18	1	1.5
	Total	75	110	10	8

1.Understand Medical Informatics and artificial intelligence:

- 1.1 Discuss about Medical Informatics.
- 1.2 Express the need for Medical Informatics in Education/Training.
- 1.3 Discuss about the prospects of Medical informatics.
- 1.4 Explain about Artificial Intelligence.
- 1.5 Explain an Expert System.
- 1.6 Express the need for Expert system.
- 1.7 Explain about Material and Methods.
- 1.8 State the need for knowledge Representation.
- 1.9 Explain the methods of knowledge representation.

1.10 List the advantages of Expert System.

1.11 List the applications of Expert System.

2. Employ Computer Instructions in various medicine fields

2.1 Identify the need for computer assisted medical education.

2.2 Explain the utility of simulation in education.

2.3 Express the need for virtual reality in medical education.

2.4 List the applications of virtual reality.

2.5 Explain the concept of Tele – Education and Tele – Monitoring.

2.6 Explain the concept of 3D Imaging.

2.7 List the limitations of Endoscopy.

2.8 Explain General Endoscopy

2.9 List the Benefits and limitations of virtual endoscopy.

2.10 List the Applications of virtual environment.

3. Employ the computers in Surgery

3.1 Name the conventional surgery procedures.

3.2 List the limitations of conventional surgery.

3.3 Apply computers in surgery.

3.4 Explain about 3D Navigation systems.

3.5 Employ 3D navigation system in orthopedic Imaging.

3.6 Explain about Merits and Demerits of Computer Assisted Surgery.

3.7 Express the need for surgical simulation.

3.8 List the applications of Surgical Simulation.

3.9 Overview on Future of Surgical Simulation.

4. Appraise the principles of Tele – Medicine

4.1 Define Tele-Medicine.

4.2 Identify the need for Tele-Medicine.

4.3 List the advantages of Tele-Medicine.

- 4.4 Explain about Technology – Materials and methods in Telemedicine.
- 4.5 Explain about peripheral Devices used in Tele-Medicine.
- 4.6 Explain about Telemedicine Systems
- 4.7 Explain the use of Internet in Telemedicine
- 4.8 Explain controversial issues related to Tele-Medicine
- 4.9 Explain reliability of Telemedicine.
- 4.10 Analysis of expenditure (cost) in Telemedicine.
- 4.11 List the applications of Telemedicine.

5.0 Appraise the principles of Tele-Surgery

- 5.1 Define Tele surgery.
- 5.2 Express the need for tele-surgery.
- 5.3 Distinguish between general surgery and tele-surgery.
- 5.4 Explain Tele-Presence.
- 5.5 Explain Tele-Mentoring.
- 5.6 Explain about Robotic Surgery.
- 5.7 List the advantages of Tele-Surgery.
- 5.8 Identify the disadvantages of Tele-Surgery.
- 5.9 Explain about Technology – Material and Methods in Telesurgery.
- 5.10 Compare the technology of telemedicine with that of Tele surgery.
- 5.11 Analyze the scope of Tele-Surgery.

COURSE CONTENTS

1. Introduction to Medical Informatics

Need for medical informatics, artificial intelligence, expert system, materials and methods, knowledge representation.

2. Computer – Assisted Instructions:

Computer Assisted medical education, simulation, virtual reality, Tele-education, Tele-monitoring, 3D imaging, virtual endoscopy.

3. Computer – Assisted Surgery

Computer – Assisted surgery, 3D navigation systems, intra-operative imaging, orthopedic 3D navigation system, surgical simulation.

4. Tele – Medicine

Need for Tele-medicine, peripheral devices in Tele-medicine, Tele-medicine systems, Internet Tele-medicine, controversial issues.

5. Tele – Surgery:

Need for Tele-surgery, Tele presence, Tele mentoring, Robotic surgery, scope of Tele surgery.

REFERENCE BOOKS

1. Medical Informatics By Mohan Bansal, Tata McGrah Hill

MEASUREMENTS & TEST EQUIPMENT LABORATORY PRACTICE

Subject Title : MEASUREMENTS & TEST EQUIPMENT LABORATORY
PRACTICE

Subject code : BM-507

Periods/week : 03

Periods/semester : 45

Rationale: Measurement & Test Equipment Lab is included in the fifth semester to make the students industry ready by giving them practical inputs and making them experiment with electronic devices which are in wide usage in industry. This helps the students to get better job opportunities and work with confidence.

LIST OF EXPERIMENTS:

1. Extension of ammeter
2. Conversion of Ammeter to Voltmeter.
3. Construction of series type ohm meter
4. Construction of shunt type ohm meter
5. Measurement of Amplitude , frequency and phase angle using CRO
6. Find phase angle and frequency by constructing Lissajous patterns
7. Construction of A/D converter
8. Construction of D/A converter
9. Testing of various ICs using IC tester
10. Testing of various transistors using Transistor tester

Exp no.	Name of the experiment	objectives	Key competencies
1.	<p>To study the PMMC meters</p> <p>a) To convert an ammeter into Voltmeter</p> <p>b) To Extend the range of voltmeter using multiplier</p> <p>c) To Measure current using voltmeter</p> <p>d) To extend the range of ammeter using a shunt</p> <p>e) To observe the Loading effect of volt meter on high impedance circuit</p> <p>f) Open and identify the following parts a) Permanent magnet b) Coil c) Former d) Phosphor bronze springs e) Pointer , Multiplier / Shunt etc</p>	<p>a) To identify the PMMC meters and observe the linear scale.</p> <p>b) Measure meter Resistance</p> <p>c) noting down full scale deflection current.</p> <p>d) Calculation of Multiplier and shunt values</p> <p>e) observe the loading effect and understand the need for high input impedance.</p> <p>f) measuring current using voltmeter.</p>	<p>a) Identify PMMC meters</p> <p>b) Understanding the importance of high input impedance of voltmeter</p> <p>c) extend the range of meters</p>

2.	<p>Measurements using CRO (both analogue and Digital)</p> <p>a) Measurement of Voltage amplitude, b) frequency and c) phase angle</p> <p>b) Measure the signal amplitude a) when the signal level is in milli Volts b) Signal level is above 80V c) Observe and measure Amplitude and Frequency of the standard signal provided on CRO</p> <p>d) observe and measure Amplitude and Frequency of Different wave forms provided in the function generator</p> <p>e)Observe the characteristics of a Pulse on CRO</p> <p>f) Connect a RC Series circuit to the function generator to create Phase difference and measure the same using lissajous patterns</p>	<p>a)To use various controls and select appropriate ranges on analog and Digital CROs</p> <p>b)Testing the BNC Cable before applying the signal</p> <p>c)Observing Positive and Negative peaks of a wave form.</p> <p>d)Measure the amplitude and frequencies of small and high level signals using CRO Probes</p> <p>e) Measuring phase angle by lissajous pattern method and interpreting them</p> <p>f) Experimentally verifying the concept of Phase angle in circuits involving RC elements. and observing the effect of variation of R and C on the phase angle at different frequencies</p>	<p>a)To measure the Amplitude , Frequency and phase angles of given Signals and also observe the waveform for its shape and Distortion.</p> <p>b) To know the Pulse parameters and Observing them on CRO</p>
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LIFE SKILLS

Subject Title	:	Life Skills
Subject Code	:	COMMON-508
Scheme	:	C-16
Periods/ Week	:	03
Periods/Semester	:	45

TIME SCHEDULE

Sl No.	UNITS	No. of periods Allotted		
		Explanation	Activities	Total
1.	ATTITUDE	1	3	4
2.	ADAPTABILITY	1	3	4
3.	GOAL SETTING	1	3	4
4.	MOTIVATION	1	3	4
5.	TIME MANAGEMENT	1	3	4
6.	CRITICAL THINKING	2	3	5
7.	CREATIVITY	1	3	4
8.	PROBLEM SOLVING	1	3	4
9.	TEAM WORK	1	3	4
10.	LEADERSHIP	1	3	4
11.	STRESS MANAGEMENT	1	3	4
TOTAL		12	33	45

Note: No Written Examination; The total 45 hours are to be considered as Theory hours.

Marks: Internal – 40; External – 60

OBJECTIVES:

Upon the completion of this course, the student shall be able to

1.0 Understand the concept of Attitude

- 1.1 Define 'Attitude'
- 1.2 Explain the importance of Attitude
- 1.3 Distinguish between Positive and Negative Attitudes
- 1.4 Life Response: Need for change of Attitude

1.5 Positive Attitude: Key to success in Personal and Professional Lives

2.0 Understand the concept of Adaptability

- 2.1 Define the term 'Adaptability'
- 2.2 Explain the concept of Adaptability
- 2.3 Advantages of Adaptability
- 2.4 Disadvantages of Lack of Adaptability
- 2.5 Need for positive response to change

3.0 Understand the concept of Goal setting

- 3.1 Define the terms 'Goal' and 'Goal Setting'
- 3.2 Explain the significance of Goal setting & Long and Short term goals
- 3.3 Explain the following concepts
 - a) Wish b) Dream c) Goal
- 3.4 Explain the reasons for and consequences of not setting goals
- 3.5 The SMART features in Goal setting

4.0 Understand the concept of Motivation

- 4.1 Define 'Motivation' ; Inspiration Vs Motivation
- 4.2 Importance of motivation in Goal setting
- 4.3 Distinguish between Internal (Self) Motivation and External Motivation
- 4.4 De-motivating Factors and how to overcome them
- 4.5 Motivating oneself and others

5.0 Understand Time Management skills

- 5.1 Define 'Time Management'.
- 5.2 Comprehend the significance of Time Management.
- 5.3 Explain the Time Quadrant
- 5.4 Common Time wasters and how to overcome them.
- 5.5 How to meet deadlines and targets within time

6.0 Understand Critical Thinking

- 6.1 Define “Critical Thinking”,
- 6.2 Understand the importance of Critical Thinking
- 6.3 Distinguish between facts and opinions (assumptions)
- 6.4 Inculcating different perspectives
- 6.5 Developing Reasoning abilities and form sound judgments

7.0 Understand Creativity

- 7.1 Understand the importance of and need for creative ideas
- 7.2 Distinguish between Linear Thinking and Lateral Thinking
- 7.3 Distinctive qualities of creative people
- 7.4 Unusual or creative use of familiar objects
- 7.5 Creative ways of solving problems

8.0 Understand Problem Solving

- 8.1. Define the concept of Problem solving
- 8.2 Viewing the problems as challenges
- 8.3 Different steps in solving a problem
- 8.4 Selecting the best solution to solve a problem
- 8.5 Lateral thinking in Problem solving

9.0 Understand Team Work

- 9.1 Define Team work
- 9.2 Develop Team skills
- 9.3 Advantages of team work
- 9.4 Understand responsibilities as a team player
- 9.5 Problems of working in a team and possible solutions

10.0 Understand Leadership

- 10.1 Define Leadership
- 10.2 Identify Leadership qualities
- 10.3 Analyze one’s strengths and limitations as a leader

10.4 Types of Leadership: Autocratic and Democratic

10.5 Leadership by example

11.0 Understand Stress Management

11.1 Define Stress

11.2 Explain the causes of stress

11.3 Learn Stress Management skills

11.4 Need for positive thinking and self esteem

11.5 Practice Stress Management strategies

COMPUTER HARDWARE & NETWORKING LAB PRACTICE

Subject Title	: Computer Hardware & Networking Lab Practice
Subject Code	: BM - 509
Periods per Week	: 03
Periods per Semester	:45

LIST OF EXPERIMENTS

- 1) Identify motherboard components
- 2) RAM identification, removal, installation.
- 3) Assembling and Disassembling of a PC
- 4) Upgradation of PC.
- 5) CMOS setup.
- 6) Practice on Partition and formatting of Hard disk
- 7) Installation of operating system software (Windows xp / Windows7)
- 8) Installation of device driver software
- 9) Installation of application software (MS-Office 2007/ 2010)
- 10)Print a summary of your system Hardware.
- 11)To recover lost data on hard drive.
- 12)Verify whether Network card is present
- 13)Preparing the UTP cable for cross and straight connections using crimping tool.
- 14)Installation of a switch and connecting systems to a network Hub / switch.
- 15)Configuration of IP Address and Subnet
- 16)Installation of a modem (internal, external or USB) and connecting to internet.
- 17)Implementation of peer to peer network
- 18)Implementation of workgroup network
- 19)Implementation of Wi-Fi Network

SI No	Name of the Experiment	Objectives	Key Competencies
1.	Identify motherboard components	Identify various components on the motherboard	Check whether the following are identified: a)Processor b)HDD c)CMOS d)PCI e)IDE f)AGP g)ISA h)NIC etc
2.	RAM identification, removal, installation	Perform RAM installation, removal and identification	Check to a)Install RAM b)Remove RAM
3.	Assembling and Disassembling of a PC	Perform Assembling and Disassembling of PC	Check to a)Assemble PC b)Disassemble PC
4.	Upgradation of PC	Perform upgradation of PC by increasing a) RAM b) HDD	Check to replace the following a)RAM b)HDD
5.	CMOS setup.	Perform CMOS setup for required changes a) Change Date and Time b) Identification of Master / Slave devices c) Change sequence of Booting	Check whether the following are done: a) Change Date and Time b) Identification of Master / Slave devices c) Change sequence of Booting

6.	Practice on formatting of Hard disk	The formatting of HDD by selecting the properties of the required HDD and choose format	Check the formatting of HDD successfully
7.	Installation of operating system software (Windows XP / Windows7)	Installation of the OS by the OS CDROM /DVD	Check whether the OS is installed
8.	Installation of device driver software	Perform installation of required device driver softwares either for a) NIC b) Chipset c) Audio / video d) Printer	Install a)NIC b)chipset c)Audio / video and other required
9.	Installation of application software (MS-Office 2007/ 2010)	Install MS Office 2007/2010 by MS-Office installation CD /DVD	Check whether the installation is done with a)MS-Office 2007 / MS-Office 2010
10.	Print a summary of your system Hardware.	Click on properties of My Computer	Check whether the summary of the System Hardware is done for the given system
11.	To recover lost data on hard drive.	(i) Choose appropriate Data Recovery software (ii) Run the Data Recovery software and (iii) Recover the files which are permanently deleted or lost due to virus	Check whether the data is recovered after the data or files are lost due to wrong deletion and virus

12.	Verify whether Network card is present	(i) Verify the Network Interfacing Card (NIC) in appropriate PCI slot	Check whether the NIC is identified properly or not.
13.	Preparing the UTP cable for cross and straight connections using crimping tool.	Perform proper UTP cable preparation with (i) Cross cable and (ii) Straight cable	Check whether the following a) cross cable b) straight cable are done and test with Switch and Computer System
14.	Installation of a switch and connecting systems to a network Hub / switch	Perform the following (i) Connect switch / Hub with power supply and networking cables connected to systems (ii) Configure systems in LAN	Check whether proper connections done with a) switch b) Connecting to systems c) Check whether the systems are in LAN
15.	Configuration of IP Address and Subnet	Perform the following (i) IP Address (ii) Subnet Address (iii) Gateway IP address (iv) Preferred DNS	Check whether the following are done properly: (i) IP Address (ii) Subnet Address (iii) Gateway IP address (iv) Preferred DNS
16.	Installation of a modem (internal, external or USB) and connecting to internet.	For external Modem: (i) Connect Modem to the system with LAN Cable (ii) Connect to the power supply	Check for the working of External Modem connected to the internet Check for the working of Internal Modem connected to the internet

		<ul style="list-style-type: none"> (iii) Check the proper internet settings For internal Modem: (i) Open system and insert Modem card in the PCI slot (ii) Install Modem driver software (iii) Connect Internet cable to the existing slot on the Modem card 	
17.	Implementation of peer to peer network	Perform peer to peer network	Prepare peer to peer network
18.	Implementation of workgroup network	<ul style="list-style-type: none"> (i) Configure Workgroup by giving workgroup name (ii) Configure two or more computer systems in the same workgroup 	Check workgroup by sharing files / folders in the Workgroup
19.	Implementation of Wi-Fi Network	<ul style="list-style-type: none"> (i) Open system cabinet (ii) Install Wi Fi Network Card in PCI slot (iii) Install Wireless Adapter card 	Check if the system is connected to the existing LAN using WiFi connection

ANALYTICAL INSTRUMENTATION LAB PRACTICE

Subject title : **Analytical Instrumentation Lab Practice**
Subject Code : **BM-510**
Periods Per Week : **03**
Periods Per Semester : **45**

S.No.	Major Topics	Periods
1.	Principle of Spectrophotometer, Colorimeter, Flame Photometer, centrifuge and incubator	12
2.	Principle of Electrophoresis, Densitometer, Chromatography	12
3.	Principle of pH meter, Conductivity meter	12
4.	Principle of Biochemical Analyzer	09
	Total	45

List of Experiments

ANALYTICAL INSTRUMENTATION LAB PRACTICE

1. To observe transmittance and absorbance of various sample solutions and measure the concentration using Spectrophotometer in the visible light region.
2. To observe transmittance and absorbance of various sample solutions and measure the concentration using Spectrophotometer in the ultra-violet region.
3. To observe transmittance and absorbance of various sample solutions and measure the concentration for various filters using Colorimeter.
4. To observe the separation of solution and sediment by using centrifuge
5. To perform an experiment to demonstrate the Principle of Electrophoresis
6. To perform an experiment to demonstrate the Principle of Densitometer
7. To perform an experiment to demonstrate the Principle of Chromatography

8. To measure the pH of various sample solutions using pH meter
9. To perform an experiment to demonstrate the Principle of Conductivity meter
10. To measure concentration of a sample solution by end point mode using automated biochemical analyzer
11. To measure concentration of a sample solution by two point mode using automated biochemical analyzer
12. To measure concentration of a sample solution by kinetic mode using automated biochemical analyzer

S.No.	Name of the Experiment	Objectives	Key Competencies
1.	Spectrophotometer Visible light region	<ol style="list-style-type: none"> 1. Familiarization with the Equipment. 2. Identify the monochromators, light sources used 3. Identify Visible light wavelength ranges 4. Identify the type of Cuvettes used 5. Preparation of sample solution 6. Calibration with standard solutions 7. Principle of Spectrophotometer 8. Cleaning the cuvettes after use. 	<ol style="list-style-type: none"> 1. Perform the experiment as per the Procedure 2. Noting down the readings at different wavelengths. 3. Calculating concentration with the obtained readings 4. Inferences
2.	Spectrophotometer with UV region	<ol style="list-style-type: none"> 1. Familiarization with the Equipment. 2. Identify the monochromators, light sources used 3. Identify UV and Visible light wavelength ranges 4. Identify the type of Cuvettes used 5. Preparation of sample solution 6. Calibration with standard solutions 7. Principle of Spectrophotometer 8. Cleaning the cuvettes after use. 	<ol style="list-style-type: none"> 1. Perform the experiment as per the Procedure 2. Noting down the readings at different wavelengths. 3. Calculating concentration with the obtained readings 4. Inferences

3.	Colorimeter	<ol style="list-style-type: none"> 1. Familiarization with equipment 2. Principle of colorimeter 3. Identify the type of monochromator, light source used 4. Identify the type of cuvette used. 5. Preparation of sample solution 6. Calibration with standard solutions 7. Cleaning of the cuvette after the use 	<ol style="list-style-type: none"> 1. To perform experiment as per the Procedure 2. Note down the readings at different wavelengths. 3. Calculating concentration with the obtained readings 4. Inferences
4.	Centrifuge	<ol style="list-style-type: none"> 1. To understand the working of centrifuge 2. Preparation of sample solution 3. Mounting the sample solution test tubes in centrifuge 4. Observe the separation of solvent and solute 5. Safety precautions while operating the equipment 	<ol style="list-style-type: none"> 1. To perform the experiment as per procedure 2. Observing the sediment and analyzing
5.	Electrophoresis	<ol style="list-style-type: none"> 1. Familiarization with electrophoresis instrument 2. Principle of electrophoresis 3. Preparation of electrolyte solution 4. Observation of segmentation of sample components on filter paper 5. Analyze the filter paper using densitometer 	<ol style="list-style-type: none"> 1. To perform the experiment as per the procedures 2. Records number of components present in the sample by the segments formed on filter paper. 3. Measures the concentration of the components using densitometer 4. Inferences 5. Applications

6.	Densitometer	<ol style="list-style-type: none"> 1. Familiarization with densitometer 2. Principle of densitometer 3. Preparation of filter paper for measuring 4. Calibration using oily filter paper 5. Mounting the filter paper on densitometer 6. Measuring optical densities of segments formed on filter paper 	<ol style="list-style-type: none"> 1. To perform the experiment as the procedure 2. Notes the optical density for different components 3. Calculates concentration of different components 4. Inferences
7.	Chromatography	<ol style="list-style-type: none"> 1. Principle of chromatography 2. Preparation of sample solution 3. Preparation of filter paper to create two different phases 4. Observes segmentation of components on the filter paper 	<ol style="list-style-type: none"> 1. To perform the experiment as per the Procedure 2. Calculates concentration 3. Inferences 4. Applications
8.	pH meter	<ol style="list-style-type: none"> 1. Familiarization with pH meter 2. Principle of pH meter 3. Preparation of Buffer solution 4. Identify the solution as acid or basic (with litmus paper) 5. Calibration with buffer solution 6. Measure pH for the given sample solutions. 7. Maintenance of pH electrodes 	<ol style="list-style-type: none"> 1. Writes Procedure 2. Noting down pH for given different solutions. 3. Inferences
9.	Conductivity meter	<ol style="list-style-type: none"> 1. Familiarization with conductivity meter 2. Principle of conductivity meter 3. Preparation of sample solution 4. Calibration with standard solution 5. Maintenance of conductivity cell 	<ol style="list-style-type: none"> 1. Writes procedure 2. Records the conductivity of given sample solution 3. Inferences 4. Applications

10.	Biochemical Analyzer in End Point Mode	<ol style="list-style-type: none"> 1. To understand the working of biochemical analyzer in end point mode 2. Principle of Biochemical analyzer 3. Selecting suitable modes 4. Selecting filters 5. Calibration using standard solutions 6. Preparation of solution 7. Measuring transmittance and absorbance percentage 8. Cuvette placing and cleaning 	<ol style="list-style-type: none"> 1. To perform the experiment as per the procedure 2. Recording %T and %A by changing in end point modes 3. Calculates concentration 4. Inferences
11.	Biochemical Analyzer in Two Point Mode	<ol style="list-style-type: none"> 1. To understand the working of biochemical analyzer in end point mode 2. Principle of Biochemical analyzer 3. Selecting suitable modes 4. Selecting filters 5. Calibration using standard solutions 6. Preparation of solution 7. Measuring transmittance and absorbance percentage <p>Cuvette placing and cleaning</p>	<ol style="list-style-type: none"> 1. To perform the experiment as per the procedure 2. Recording %T and %A by changing in end point modes 3. Calculates concentration 4. Inferences
12	Biochemical Analyzer in Kinetic Mode	<ol style="list-style-type: none"> 1. To understand the working of biochemical analyzer in end point mode 2. Principle of Biochemical analyzer 3. Selecting suitable modes 4. Selecting filters 5. Calibration using standard solutions 6. Preparation of solution 7. Measuring transmittance and absorbance percentage <p>8. Cuvette placing and cleaning</p>	<ol style="list-style-type: none"> 1. To perform the experiment as per the procedure 2. Recording %T and %A by changing in end point modes 3. Calculates concentration 4. Inferences

VI SEMESTER

**3 & ½ DIPLOMA
IN BIOMEDICAL ENGINEERING**

**SCHEME OF INSTRUCTION AND EXAMINATION
SIXTH SEMESTER**

Sub Code	Name of the Subject	Instruction		Total Periods/ Semester	Scheme of Examination				
		T	P		Duration (HRS)	Sessional Marks	End Exam Marks	Total Marks	
BM-601	Hospital Management & Entrepreneurship	6	--	90	3	20	80	100	
BM-602	Microcontroller & Embedded Systems	6	--	90	3	20	80	100	
BM-603	Advanced Biomedical Equipment	6	--	90	3	20	80	100	
BM-604	Medical Imaging Techniques	6	--	90	3	20	80	100	
BM-605	Biomedical Signal Processing	6	--	90	3	20	80	100	
BM-606	Microcontroller & Embedded Systems Lab Practice	--	3	45	3	40	60	100	
BM-607	Biomedical Equipment Lab Practice	--	3	45	3	40	60	100	
BM-608	Biomedical Signal Processing Lab Practice	--	3	45	3	40	60	100	
BM-609	Biomedical circuits Design & Servicing Lab	--	3	45	3	40	60	100	
		30	12	630	27	260	640	900	

HOSPITAL MANAGEMENT & ENTREPRENEURSHIP

Subject Title : **Hospital Management & Entrepreneurship**

Subject Code : **BM – 601**

Periods per Week : **06**

Periods per Semester : **90**

TIME SCHEDULE

S.No	Major Topics	Periods	Weightage of marks	Short ques (S)	Essay Ques (E)
1.	Principles & Functions of Management	10	13	1	1
2.	Administration of Hospital Systems & Services	20	26	2	2
3.	Hospital Planning	15	21	2	1½
4.	Role of Entrepreneur and Entrepreneurial Development	10	13	1	1
5.	Industrial Legislation & Safety Policies	15	16	2	1
6.	Smart technologies	20	21	2	1½
	Total	90	110	10	8

OBJECTIVES

1.0 Understand the principles of Management.

- 1.1 State the Role of Industry,
- 1.2 Mention various types of Industries and their Ownership
- 1.3 Understand about sole proprietor ship.
- 1.4 Understand about partner ship
- 1.5 Know about Public & Private limited Companies.
- 1.6 Discuss about Shares & Debentures of a company.
- 1.7 State the functions of Management.

2.0 Administration of Hospital Systems & Services .

- 2.1 State the Role of Bio-medical Engineer in hospitals, Industry & Research Institutions.
- 2.2 Distinguish between hospital & Industry & Research institutions.
- 2.3 Discuss the features of Organization in Hospital.
- 2.4 Classification the various Hospitals.
- 2.5 Identify various departments of the hospitals.
- 2.6 State the purpose and services offered by primary health care system.
- 2.7 Give an overview, location, design & organization of Emergency service, outpatient services, Engineering services, Auxiliary services, Nourishing services
- 2.8 Give an overview of drugs & medical supplies.
- 2.9 Explain the Records Management.

3.0 Know about Hospital Planning:

- 3.1 State the principles of planning.
- 3.2 State the factors for selecting the location
- 3.3 State the factors for selecting the site
- 3.4 Know about Hospital Layout.
- 3.5 Know about Budgeting.

4.0 Comprehend the concept, need and importance of entrepreneurship.

- 4.1 State the concept of entrepreneur and Role of entrepreneur in small Industries department.
- 4.2 State the requirements of an entrepreneur.
- 4.3 Write down the characteristics of entrepreneur.
- 4.4 List the self employment schemes available.
- 4.5 Pre market survey.
- 4.6 Do product selection
- 4.7 Do site selection.
- 4.8 Draw plant layout.
- 4.9 Know about the technical support & collaborations.
- 4.10 List financial support system and their schemes.
- 4.11 Explain the methods of organizing resources.
- 4.12 State Marketing and sales department functions.
- 4.13 Write down the factors to be considered for promoting the sales.
- 4.14 State the need for Co – operation between sales & service departments for enterprise development

5.0 Know about various safety considerations and Comprehend various Legislations & policies.

- 5.1 List different hazards in Industry & Hospitals
- 5.2 State the importance of safety & security.
- 5.3 Mention various fire hazards and the safety precautions to prevent them
- 5.4 Explain Alarm procedure for bomb threat.
- 5.5 List various electrical hazards & precautions to be taken to prevent them.
- 5.6 National health policy.
- 5.7 State health policy.
- 5.8 Health legislation
- 5.9 Patient & consumer protection Act - 1986
- 5.10 Factories Act.
- 5.11 Minimum wages Act.
- 5.12 Industrial disputes Act.
- 5.13 Responsibilities of Employees & Employers.
- 5.14 Employer & employee relation
- 5.15 Welfare activities.
- 5.16 Medical Insurance and Policies.

6. Smart Technologies

- 6.1 Get an overview of IoT(Internet of Things)
- 6.2 Define the term IoT
- 6.3 Know how IoT work
- 6.4 List the key features of IoT
- 6.5 List the components of IoT : hardware, software, technology and protocols
- 6.6 List the advantages and disadvantages of IoT
- 6.7 IoT Applications
 - 6.7.1 Smart Cities
 - 6.7.2 Smart Energy and the Smart Grid
 - 6.7.3 Smart Transportation and Mobility
 - 6.7.4 Smart Home, Smart Buildings and Infrastructure
 - 6.7.5 Smart Factory and Smart Manufacturing
 - 6.7.6 Smart Health
 - 6.7.7 Food and Water Tracking and Security
 - 6.7.8 Social Networks and IoT

Course Contents

1. Principles and functions of management.

Definitions of Industry, Commerce and Business. Evolution of management theories. Principles of Scientific Management, functions of management. Difference of administration and management.

2. Administration of Hospital Systems & Services

Biomedical equipment procurement procedure, proper selection, standardization. Capability, safety requirements, spares requirement, Evaluation, testing & installation, purchase & contract procedure, Training to medical staff on technical capabilities and proper use of Bio – medical Equipment, operating instructions. Bio-medical equipment maintenance procedures, mandatory requirements, preventive maintenance & periodical servicing procedures, preparation of servicing schedules, fault diagnosis, Repairs & modifications, maintenance of log books.

Functional organization of Biomedical/clinical Engg., department lay out & setting of clinical Engineering lab/workshop, requirements, test & servicing of Equipment.

3 Hospital Planning.

Principles of planning, selection of location, site & orientation, Budgeting layout, organization of the hospital, equipment plans.

4. Entrepreneurship

Role, characteristics and functions of entrepreneur, Role of small scale industries, self employment schemes, planning, product selection, site selection, plant selection, Technical & financial support, marketing and sales management.

5. Industrial Legislation & Safety, policies

Importance of safety at work place, security and loss prevention, fire safety bomb threat, Alarm systems.

National, state health policies, health legislation, role of natural justice in hospital administration. The patient and the consumer protection act 1986, supreme court judgement on medicos, Indian factories act, minimum wages act, industrial disputes act, work merit compensation act, rights and responsibilities of employers & employees.

6. Smart Technologies :

Overview of IoT - Define IoT, how IoT work, key features of IoT, components of IoT : hardware, software, technology and protocols, advantages and disadvantages of IoT - IoT Applications - Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing, Smart Health, Food and Water Tracking and Security, Participatory Sensing, Social Networks and IoT.

TEXT BOOKS

1. Hospitals planning, design & Management by G.D. Kunders, S. Gopinath A. Katakam (Tata Mc.Graw hill)
2. Hand book of Hospital personnel Management by R.C. Goyal (PHI)
3. Source book of modern technology for hospital by Soni Ashok (ISHA, Bangalore 1992)
- 4 Industrial Engineering and management by Dr.O.P.Khanna
- 5.Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Book_Open_Access_2013 pages-54-76

REFERENCE BOOKS

- 1 Entrepreneurship by TTTI, Madras
- 2 Total quality management by Joel E.Ross.

MICROCONTROLLER & EMBEDDED SYSTEMS

Subject Title : Microcontroller & Embedded Systems
Subject Code : BM – 602
Periods Per Week : 06
Periods Per Semester : 90

SI	Major Topics	No. of periods	Weightage of Marks	Short Answer Questions	Essay Questions
1	8051 Architecture	20	26	2	2
2	8051 Assembly Programming	20	26	2	2
3	Interfacing	25	29	3	2
4	Embedded System & RTOS	15	16	2	1
5	PIC & ARM microcontrollers	10	13	1	1
	Total	90	110	10	8

OBJECTIVES

On completion of the study of the subject a student should be able to comprehend the following:

1.0 Understand the Architecture of 8051 Microcontroller

- 1.1 Compare and contrast microprocessors and microcontrollers.
- 1.2 List features of the 8051.
- 1.3 List various members of the 8051 family and compare them.
- 1.4 List different applications of 8051 Microcontroller.
- 1.5 Sketch and explain the internal block diagram of 8051 Microcontroller
- 1.6 List the registers of the 8051 Microcontroller.
- 1.7 Define ROM and RAM memories and describe their use in 8051 based systems.
- 1.8 Explain Memory organization in 8051.

- 1.9 List Special Function Registers (SFR) of 8051
- 1.10 Explain Stack and stack pointer
- 1.11 Explain Program counter and DPTR
- 1.12 Sketch the pin diagram of 8051 Microcontroller and know the function of each pin.
- 1.13 Explain Input/output ports.
- 1.14 Explain Counters and timers
- 1.15 Explain Serial port.
- 1.16 Explain Interrupts and their priorities

2.0 Know about 8051 Assembly programming.

- 2.1 Mention about the different addressing modes of 8051 and explain them with examples
- 2.2 Describe five major groups of instructions: Data transfer, Arithmetic, Logical, Single bit instructions and Branching instructions.
- 2.3 Practice programs using data transfer instructions.
- 2.4 Practice programs using Arithmetic instructions.
- 2.5 Practice programs using Logical instructions.
- 2.6 Practice programs using single bit instructions.
- 2.7 Practice programs using Branch instructions and delay programs
- 2.8 Practice Timer and Counter programs.
- 2.9 Implement 8051 programming in C language.
- 2.10 Write programs using C.

3.0 Know about 8051 Interfacing

- 3.1 Explain the need of Interfacing.
- 3.2 List interfacing devices and their functions.
- 3.3 Explain the different modes of 8255.
- 3.4 Draw the functional block diagram of 8255 and explain each block.
- 3.5 Explain control word.
- 3.6 Explain the interfacing of 8255 with 8051.
- 3.7 Explain the functional block diagram of 8257 DMA controller.

- 3.8 Explain the functional block diagram of 8251 USART.
- 3.9 Explain the functional block diagram of 8259 PIC
- 3.10 Explain the interfacing of external memory with 8051.

4.0 Introduction to Embedded System & Real Time Operating System (RTOS)

- 4.1 Describe the concept of Embedded system and give examples of Embedded systems.
- 4.2 Give components of Embedded Systems.
- 4.3 Classify Embedded Systems.
- 4.4 Discuss the architecture of Embedded Systems.
- 4.5 List features of important processors used in Embedded Systems.
- 4.6 List Bus standards for serial and high speed communication.
- 4.7 Explain parallel communication using ISA, PCI and PCI/X bus standards.
- 4.8 Discuss about software architecture used in Embedded Systems
- 4.9 Explain importance and functions of Device drivers.
- 4.10 List features of Real-Time Operating Systems.
- 4.11 Explain Architecture of Kernel.
- 4.12 Explain Task and Task scheduler.
- 4.13 Discuss context switching.
- 4.14 Explain scheduler issues in RTOS like
 - i. Scheduler algorithms
 - ii. Semaphores, mutex, mailbox
 - iii. Inter process communication
 - iv. Dead lock handling
 - v. Shared data handling
- 4.15 Give importance of functions like Messages and Queues in RTOS.

5.0 Introduction to PIC & ARM Microcontrollers

- 5.1 Give the architecture of PIC microcontroller.
- 5.2 Harvard architecture, and pipelining.
- 5.3 Mention the on chip peripherals of PIC

- 5.3 Explain the ARM7 CPU core Architecture with Block diagram
- 5.4 Discuss Memory organization in ARM7
- 5.6 Know the importance of ARM7 instruction set and THUMB instructionset,
- 5.7 On chip peripherals of ARM7- MAC unit, Real Time clock

COURSE CONTENT:

- 1. Architecture of 8051** –Block diagram of 8051, Pin diagram of 8051, memory Organization, internal registers and special function registers.
- 2. 8051 Assembly programming** – Addressing modes. Classification of instruction set like– Data transfer, Arithmetic, logical, single bit, and branching instructions. Practice programs using data transfer, Arithmetic, logical, single bit, branching instructions. Interrupt programs, Timers and Counters programs. Implementation of C language.
- 3. 8051 interfacing**
8255 modes, interfacing 8255 with 8051, DMA controller 8257, Interrupt controller 8259, interfacing external memory with 8051.
- 4. Introduction to Embedded Systems & RTOS**
Importance of Embedded Systems, Embedded Hardware and software architectures ,Device drivers. Introduction to Real-Time Operating Systems, Processor management / Scheduling, Memory management, Tasking and their states, Scheduler, Issues related to shared data, deadlocks, Semaphores, I/O management. Messages, Queues.
- 5. Introduction to PIC & ARM Microcontrollers.**
Architecture of PIC micro controller. On chip peripherals. Overview of available PIC micro controllers. Architecture of ARM7 micro controller, memory organization, on chip peripherals.

TEXT BOOKS

1. The 8051 Microcontroller and Embedded System Muhammad Ali Mazid
Janice Gillispie Mazidi
2. An Embedded Software Primer – David E. Simon
3. Embedded Systems – Raj Kamal (TMH)

Reference books

1. Embedded/Real time systems concepts ,design and programming – Dr.
K.V.K.K. Prasad.
2. Programming and customizing the 8051 Microcontroller -- Myke Predko
Intel 8051 datasheet. From www.intel.com

Advanced Bio Medical Equipment

Subject Title	:	Advanced Bio Medical Equipment
Subject Code	:	BM - 603
Periods Per Week	:	06
Periods per Semester	:	90

TIME SCHEDULE

Sl.No.	Major Topics	Periods	Weightage of Marks	Short Ques (S)	Essay Ques (E)
1	Oxygenators, hemodialysis and OT equipment's	20	29	3	2
2	Audiometer, and Physiotherapy Equipment	20	26	2	2
3	Endoscopy & Lasers	20	26	2	2
4	IABP and Infusion systems	18	16	2	1
5	Electrical safety	12	13	1	1
	Total	90	110	10	8

OBJECTIVES

On completion of the study of the subject a student should be able to comprehend the following:

1.0 Principles & types of Oxygenators & OT equipment

- 1.1 Give the Need for a heart – lung machine
- 1.2 List the Qualitative requirements of an oxygenator
- 1.3 Explain the Principle of different types of oxygenators
- 1.4 Explain the working principle of heart-lung Machine with a neat diagram
- 1.5 Compare the types of oxygenators
- 1.6 Give the need of a hemodialysis.
- 1.7 Compare hemodialysis and peritoneal dialysis

- 1.8 Describe the principle of dialyzers
- 1.9 Sketch the block diagram of Hemodialysis machine and explain
- 1.10 Describe the principle of electrosurgical unit with diagram
- 1.11 List different techniques in ESU.
- 1.12 Define the common techniques in electro surgery.
- 1.13 List the types of voltage wave forms used in cutting & coagulation.
- 1.14 Explain the block diagram of a typical electrosurgical unit.
- 1.15 List the types of electrodes used in ESU operation.
- 1.16 List possible hazards and safety measures in electrosurgical procedures.

2.0 Audiometer, and Physiotherapy Equipment:

- 2.1 Give the need for an audiometer
- 2.2 Explain Air and Bone conduction in audiometry.
- 2.3 Describe basic audiometer with diagram
- 2.4 List general requirements of audiometers.
- 2.5 Explain evoked response audiometry system with block diagram.
- 2.6 Explain calibration of audiometers.
- 2.7 List different types of hearing aids and explain them
- 2.8 Explain stone disease problems
- 2.9 Explain modern Lithotripter system
- 2.10 Explain extra corporeal shock wave therapy
- 2.11 Explain working principle of short wave diathermy
- 2.12 Explain microwave diathermy
- 2.13 Explain principle of ultrasonic principle in diathermy

3.0 Principle of Endoscopy & LASERS.

- 3.1 Explain the principle of light transmission through a fibre optic cable.
- 3.2 Explain the principle of a basic endoscopic system.
- 3.3 Name the types of endoscopes and their operations.
- 3.4 List the applications of different types of endoscopes.
- 3.5 Explain the principle of capsule endoscopy
- 3.6 List the applications of capsule endoscopy

- 3.7 Explain the principle of operation of laser.
- 3.8 Classify lasers.
- 3.9 Explain the principle of operation of He, Ne, CO₂, Ar, Ruby, Nd – YAG, eximer, and semiconductor lasers.
- 3.10 Compare all the above lasers.
- 3.11 List the applications of different lasers.

4.0 understand the principles of IABP and infusion systems

- 4.1 Concept of counter pulsation
- 4.2 Express the need of Intra-aortic balloon pump
- 4.3 Explain the principle of operation of IABP
- 4.4 List the applications of IABP machine
- 4.5 Explain the principle of operation of drug delivery system
- 4.6 Explain the block diagram of infusion pump
- 4.7 List the applications of infusion and syringe pumps

5.0 Patient Electrical safety instrumentation

- 5.1 Discuss the patient electrical safety measures
- 5.2 Explain the Electric shock hazards
- 5.3 Define Microcurrent shock and Macrocurrent shock
- 5.4 Compare Microcurrent shock and Macrocurrent shock
- 5.5 Explain about the Leakage currents
- 5.6 List precautions to minimize Electric Hazards
- 5.7 Describe safety codes for Electromedical equipment
- 5.8 Explain electrical safety analyzer
- 5.9 Explain the testing safety parameters of biomedical equipment

COURSE CONTENTS

1. **Oxygenators ,Hemodialysis and OT equipment:** Heart lung machine, types of oxygenators,dialyzers,Hemodialysis, ESU, electrodes in ESU, hazards and safety measures
2. **Audiometer, and Physiotherapy Equipment:** Common tests and procedures, audiometer, hearing aids, Principle of operation, types of dialysers, monitoring circuits for critical parameters, modern Lithotripsy system, working principle of physiotherapy equipment-short wave, microwave, and ultrasound
3. **Principle of Endoscopy & LASERS.** optic cable, types of endoscopes .Principle of production of HE, Ne, RUBY, Nd , YAG, CO₂, Ar, Kr,LASERS.
4. **Intra aortic balloon pump and infusion systems:** IABP,Infusion pumps,Syringe pumps
5. **Patient Electrical safety instrumentation:** patient electrical safety measures,Electric shock hazards,Microcurrent shock and Macrocurrent shock,Leakage currents, precautions to minimize Electric Hazards,safety codes for Electromedical equipment, electrical safety analyzer, testing safety parameters of biomedical equipment

TEXT BOOKS

- 1.Hand Book of Biomedical Instrumentation by R.S.Khandpur (Tata Mc Graw Hill)
2. Hand Book of Biomedical Engg. By Joseph D. Bronzino (CRU Press)
- 3.Encyclopedia of medical instrumentation & devices by John g. Webster (Vol.I,II,III,IV)

MEDICAL IMAGING TECHNIQUES

Subject Title : Medical Imaging Techniques

Subject Code : BM-604

Periods Per Week : 06

Periods per Semester : 90

TIME SCHEDULE

S.No	Major Topics	No. of periods	Weightage of Marks	Short ques (S)	Essay ques (E)
1	X- Ray Imaging and Fluorescence	25	29	3	2
2	Computed Tomography and MRI	20	26	2	2
3	Radioactive Imaging	20	26	2	2
4	Ultrasound Imaging	25	29	3	2
	Total	90	110	10	8

OBJECTIVES

On completion of the study of the subject a student should be able to comprehend the following:

1.0 X-ray imaging.

- 1.1 Explain Electromagnetic spectrum with various frequencies and wave length.
- 1.2 List the properties of X-ray.
- 1.3 Explain Interaction of X-ray with matter.
- 1.4 Explain production of X-rays.
- 1.5 Explain Stationary anode X-ray tube & Rotating anode X-ray tubes.
- 1.6 Explain the Principle and need for Beam restriction.
- 1.7 Describe Collimators with diagram
- 1.8 Explain Grids & their significance.

- 1.9 Explain operating principle and construction details of X-ray machine.
- 1.10 List the Applications of X-ray imaging
- 1.11 List the Limitations of X-ray imaging
- 1.12 Explain fluorescence procedure with block diagram
- 1.13 List the advantages and limitations of fluorescence.
- 1.14 Distinguish between fluorescence and X-ray imaging.
- 1.15 Explain the need and construction of image intensifier.
- 1.16 Explain the Principle of angiography
- 1.17 List the applications of angiograph.

2.0 CT and MRI based Procedure:

- 1.1 Explain the principle of CT
- 1.2 Describe various CT generations with diagrams
- 1.3 Explain CT machine in detail
- 1.4 Explain various CT image reconstructing methods.
- 1.5 Explain various types of detectors used in CT machine.
- 1.6 List the applications of CT
- 1.7 List the advantages of CT over X-ray imaging.
- 1.8 List limitations of CT imaging.
- 1.9 Explain principle of NMR
- 1.10 List Application and advantages of MR imaging.
- 1.11 List the limitations of MRI.

3.0 Radioactivity in Imaging:

- 3.1 Recall the physics of radioactivity.
- 3.2 Apply Radionuclide isotopes in medical diagnosis.
- 3.3 Name and define the units of radioactivity.
- 3.4 Explain the interaction of radionuclide elements with matter.
- 3.5 Explain thermo luminescent dosimeter with diagram.
- 3.6 Describe the working of film badge with diagram.
- 3.7 Explain the principle of GM counter.
- 3.8 Explain working of Ionization chamber.

- 3.9 Explain working of Gamma camera with a block diagram.
- 3.10 Explain single photon emission computed tomography (SPECT).
- 3.11 Explain positron emission tomography (PET).
- 3.12 List the applications and advantages of PET.

4.0 Ultrasonic principle in imaging.

- 4.1 Define piezoelectric effect.
- 4.2 Explain Characteristics impedance
- 4.3 Explain the importance of Resolution
- 4.4 Explain Generation of ultrasound
- 4.5 Explain Detection of ultra sound.
- 4.6 List Different types of transducers.
- 4.7 Explain A-scan, B-scan and M-scan.
- 4.8 List the applications of A, B, and M-scans.
- 4.9 Explain the block diagram of Basic pulse echo system
- 4.10 Explain the block diagram of Echo cardiograph.
- 4.11 List the advantages of Echo – cardio graph.
- 4.12 List the applications of Echocardiograph.
- 4.13 Explain the Principle and application of echo encephalography.
- 4.14 Explain the principle of Doppler Effect.
- 4.15 Explain the Biological effects of ultrasound.
- 4.16 List the limitations of ultrasound.

COURSE CONTENT:

- 1. X – Ray imaging:** Electromagnetic spectrum, properties of X-rays , interaction of x-rays with matter production of X-rays , stationary and

rotating anode X-ray tubes, beam restrictors, X-ray machine Grids and Intensifying screens.

2. Computed Tomography and Magnetic Resonance Imaging:

Principle of CT, various generations of CT machines, types of detectors, image reconstructions techniques, applications, MRI principle, applications of MRI

3. Radioactivity Imaging: physics of radioactivity, interaction of radionuclide elements with matter, thermoluminescent dosimeter, GM counter, Ionization chamber, Gamma camera, PET and SPECT

4. Ultrasonic imaging

Properties of Ultrasonic waves, characteristic impedance, principles, generation and detection of ultrasonic waves, different types of transducers A,B,M modes scanners, applications. Basic pulse echo system, display devices, echo cardiograph. Echo encephalography, applications.

TEXT BOOKS

1. Hand Book of Biomedical instrumentation by R.S. Khandpur (Tata Mc hill)
2. Hand book of Biomedical, Engg. By Joseph D. Bronzino (CRU Press)
3. Encyclopedia of medical instrumentation and devices by John g. Webster (Vol. I,II, III, IV)

BIO MEDICAL SIGNAL PROCESSING

Subject Title	:	Bio Medical Signal Processing
Subject Code	:	BM-605
Periods per Week	:	06
Periods per Semester	:	90

TIME SCHEDULE

Sl.No.	Major Topics	Periods	Weightage of Marks	Short Type (S)	Essay type (E)
1.	Analog and Discrete Signals	25	26	2	2
2.	Classical spectral Estimation Techniques	13	16	2	1
3.	EEG signal processing, Parametric modeling & Adaptive filters	20	26	2	2
4.	ECG signal processing & Prony's method	20	26	2	2
5.	Data compression and Reconstruction	12	16	2	1
	TOTAL	90	110	10	8

OBJECTIVES

1.0 Apply concepts of Analog Signals and Discrete Signals in signal processing

- 1.1. Definition and classification of various signals
- 1.2. Definition and classification of systems
- 1.3. Interpret Signal representation by continuous exponentials
- 1.4. Interpret Signal representation by generalized exponentials
- 1.5. Definition of Fourier transform and list its properties
- 1.6. Restate the Existence of Fourier transform
- 1.7. Definition of Laplace transform

- 1.8. List the Properties of Laplace transform
- 1.9 Explain Sampling theorem
- 1.10 Discuss the sampling basics
- 1.11 Explain simple biomedical signal conversion systems
- 1.12 List Conversion requirements for biomedical signals.
- 1.13 Discuss the importance of digital filters in biomedical signal processing
- 1.14 Describe the Elements of a digital filter

2.0 Analyze Classical spectral Estimation Techniques

- 2.1 Definition of Discrete Fourier transform (DFT)
- 2.2 Explain Computation of DFT
- 2.3 Explain Decimation in time (DIT) FFT Algorithm
- 2.4 Explain Decimation in frequency (DIF) FFT Algorithm
- 2.5 Explain Periodogram method
- 2.6 Explain analysis of auditory evoked potentials (AEP's) using the periodogram
- 2.7 Describe Cepstrum analysis
- 2.8 Analysis of the ECG signal using Cepstrum analysis

3.0 Apply parametric modeling in EEG, Adaptive filters in ECG & EEG signal processing

- 3.1 Discuss EEG signals & it's characteristics
- 3.2 Explain Automation of EEG signals
- 3.3 Describe Linear Prediction & Autoregressive (AR) methods
- 3.4 Explain AR modeling of Seizure EEG
- 3.5 Explain AR modeling of ECG signals
- 3.6 Explain Principle of Adaptive noise canceling
- 3.7 Apply ANC principle in ECG monitoring
- 3.8 Apply ANC principle fetal ECG monitoring
- 3.9 Application of ANC principle in EEG monitoring

4.0 Analyze ECG signal processing using Prony's method

- 4.1 Describe Power spectrum of ECG
- 4.2 Discuss QRS detection Techniques
 - a) Differentiation technique
 - b) Template matching technique
- 4.3 Explain QRS detection algorithm

- 4.4 Explain Automated ECG analysis
- 4.5 Analyze ST segment in ECG
- 4.6 Explain microprocessor based Arrhythmia monitor
- 4.7 Define Prony's Method
- 4.8 Describe Summarizing steps of original Prony's method
- 4.9 Analysis of heart valve sounds using Prony's method

5.0 Understand Data compression and Reconstruction

- 5.1 Discuss about Data reduction techniques
- 5.2 Describe Basics of Signal Averaging
- 5.3 Definition of PRD
- 5.4 Explain Turning point algorithm with flow chart
- 5.5 Explain AZTEC Algorithm with flow chart
- 5.6 Explanation of CORTES algorithm with flow chart.
- 5.7 Reconstruction of AZTEC data
- 5.8 Reconstruction of CORTES data with example

COURSE CONTENTS

1. Analog Signals

Definition and classification of various signals and systems, signal representation by continuous exponentials, direct and inverse Fourier transforms, continuous, spectrum, existence and properties of Fourier transforms, signal representation by generalized exponentials, the laplace transform, properties of laplace tranform,

Discrete signals

Sampling of continuous time signals , importance of sampling, discrete system, Z – transforms and its properties, importance of digital filters , types of digital filters, FIR,IIR & Integer filters

- ### **2. Classical Spectral Estimation Techniques** : Definition of DFT, FFT , decimation in time and frequency algorithms, Periodogram method, cepstrum analysis ,and it's biomedical applications

- ### **3. EEG signal processing:**Parametric modeling, Adaptive filters

EEG signals, Automation of EEG ,AR Modeling, Adaptive noise cancellation principle, and it's biomedical applications

4. ECG Signal Processing & Prony's method :Preprocessing , QRS detection method, Automated ECG analysis Arrhythmia detection algorithm, Original Prony's method, and it's biomedical applications

5. Data compression & Reconstruction

Data reduction algorithms – AZTEC, TP and CORTES algorithms.

REFERENCE BOOKS

1. Biomedical digital signal processing by Willis J. Tompkins
2. Digital Signal processing by Alan v. Oppenheim and Ronald W. Schafar.
3. Signals, system and communications by B.P. Lathi
4. Signals and system by Oppenheim and Will sky
5. Biomedical digital signal processing by Matin Akay
6. Biomedical Signal Processing by D.C Reddy

MICROCONTROLLER AND EMBEDDED SYSTEMS LAB PRACTICE

Subject Title	:	Microcontroller and Embedded systems Lab
Subject Code	:	BM- 606
Periods per Week	:	03
Periods per Semester	:	45

LIST OF EXPERIMENTS

1. Familiarization of 8051Microcontroller kit hardware and usage
2. Demonstration of Microcontroller software KEIL/SPJ/MOD51
3. Simple programs using MCS Assembly language and handling types of data formats and addressing modes
4. Write simple programs using Arithmetic instructions
5. Write simple programs using Logical Instructions
6. Write simple programs using Jump and Loop instructions
7. Write simple programs using Timers and Interrupt instructions
8. Connecting LEDs to a port and glowing it (continuously ON and Alternately ON/OFF)
9. Configuring one port as input and another port as output
10. To design Traffic controller
11. To transfer data serially and receive data serially.
12. To generate waveforms – square, ramp.
13. Small project
 - a. Simple calculator
 - b. Function generator

Expt. No.	Experiment Name	Competencies	Key Competencies
Programming experiments			
1	Familiarize with Microcontroller kit - hardware	<ol style="list-style-type: none"> 1. Identify the components on the Microcontroller Kit 2. Identify the various Connectors used with the kit 3. Identify the IC chips on kit 	<ol style="list-style-type: none"> 1. Understanding the kit details 2. Drawing inference and writing report about the Kit
2	Using Microcontroller simulation software KEIL/SPJ/MO D51	<ol style="list-style-type: none"> 1. Understand the IDE environment 2. Understand the sequence of steps to open and create new project 3. Selection of components from pop-up menus 4. Understand method of debugging 5. Method of compiling 6. Observing results 7. Saving project 	<ol style="list-style-type: none"> 1. Using Microcontroller Software KEIL/SPJ 2. Writing report on software usage
3	Simple programs using MCS Assembly language and handling types of data formats and addressing modes	<ol style="list-style-type: none"> 1. Writing programs for handling Binary, Hex, Decimal and Octal data 2. Data access using different addressing modes 3. Execute and observe the results 	<ol style="list-style-type: none"> 1. Data handling capacity 2. Writing report on data handling, and mis-handling
4	Write simple programs using Arithmetic instructions	<ol style="list-style-type: none"> 1. Knowledge of arithmetic instructions 2. Knowledge of addressing modes 4. Writing programs for all arithmetic operations 5. Data access using different addressing modes 6. Execute and observe the results 	<ol style="list-style-type: none"> 1. Capacity to analyze arithmetic operation instructions 2. Capacity to handle data from various locations 3. Writing report of the inferences

5	Write simple programs using Logical Instructions	<ol style="list-style-type: none"> 1. Knowledge of Logical instructions 2. Knowledge of addressing modes 3. Writing programs for all Logical operations 4. Data access using different addressing modes 5. Execute and observe the results 	<ol style="list-style-type: none"> 1. Capacity to analyze Logical operation instructions 2. Capacity to handle data from various locations 3. Writing report of the inferences
6	Write simple programs using Jump and Loop instructions	<ol style="list-style-type: none"> 1. Knowledge of Jump and Loop instructions 2. Knowledge of addressing modes 3. Writing programs for all Jump and Looping operations 4. Execute and observe the results 	<ol style="list-style-type: none"> 1. Capacity to analyze Jump and Loop operation instructions 2. Capacity to handle data from various locations 3. Writing report of the inferences
7	Write simple programs using Timers and Interrupt instructions	<ol style="list-style-type: none"> 1. Knowledge of Timers and Interrupt instructions 2. Knowledge of addressing modes 3. Writing programs for all Timers and Interrupt instructions operations 4. Data access using different addressing modes 5. Execute and observe the results 	<ol style="list-style-type: none"> 1. Capacity to analyze Timers and Interrupt operation instructions 2. Capacity to handle data from various locations 3. Writing report of the inferences
Interfacing and Applications experiments			
8	Connecting LEDs to a port and glowing it (continuously ON and Alternately ON/OFF)	<ol style="list-style-type: none"> 1. Knowledge of port configuration 2. Knowledge of data transfer instructions 3. Knowledge of loop instructions 	<ol style="list-style-type: none"> 1. Capacity to analyze Timers and Interrupt operations and instructions 2. Handling interfacing with ports 3. Writing report of the inferences
9	Configuring one port as input and another port as output	<ol style="list-style-type: none"> 1. Knowledge of port configuration 2. Knowledge of data transfer instructions 3. Knowledge of loop instructions 	<ol style="list-style-type: none"> 1. Capacity to analyze configuring ports as input and out put 2. Handling interfacing with ports 3. Writing report of the inferences

10	Traffic controller	<ol style="list-style-type: none"> 1. Knowledge of port configuration 2. Knowledge of data transfer instructions 3. Knowledge of loop instructions 4. Knowledge of timer instructions 5. Knowledge of jump instructions 	<ol style="list-style-type: none"> 1. Capacity to analyze configuring ports as input and out put 2. Handling interfacing with ports 3. Writing report of the inferences drawn from application
11	Serial data handling	<ol style="list-style-type: none"> 1. Knowledge of port configuration 2. Knowledge of data transfer instructions 3. Knowledge of loop instructions 4. Knowledge of timer instructions 5. Knowledge of jump instructions 	<ol style="list-style-type: none"> 1. Capacity to analyze configuring ports as input and out put 2. Handling interfacing with ports 3. Writing report of the inferences drawn from application
12	Generating waveforms	<ol style="list-style-type: none"> 1. Knowledge of port configuration 2. Knowledge of data transfer instructions 3. Knowledge of loop instructions 4. Knowledge of timer instructions 5. Knowledge of jump instructions 	<ol style="list-style-type: none"> 1. Capacity to analyze configuring ports as input and out put 2. Handling interfacing with ports 3. Writing report of the inferences drawn from application
13	<p>Small project</p> <ol style="list-style-type: none"> a. Simple calculator b. Function generator 	<ol style="list-style-type: none"> 1. Problem definition 2. Identifying requirements 3. Complete knowledge of 8051 ports, registers and instruction set 4. Burning the software on EPROM 	<ol style="list-style-type: none"> 1. Understand how to develop a project 2. Project report writing 3. Capacity to develop a prototype product.

BIO-MEDICAL EQUIPMENT LAB PRACTICE

Subject title : **Biomedical equipment lab Practice**
Subject code : **BM-607**
Periods per week : **3**
Periods / Semester : **45**

TIME SCHEDULE

SI NO	Major Topics	Periods
1	Physio screen and Cardiac Equipment	20
2	Diathermy Equipment, Nerve Muscle Stimulators and EMG	20
3	Various Biomedical Equipment	20
	Total	60
	Periods	

List of the Experiments

1. To observe the principle and operation of Physioscreen
2. To observe different heart sounds using Phonocardiogram
3. To observe different ESU techniques
4. To demonstrate the working principle of Defibrillator
5. To observe the effect of the Shortwave diathermy on subject
6. To observe remote transmission of physiological signals using Bio telemetry
7. To demonstrate the working of portable X-ray machine
8. To demonstrate the principle of Pacemaker
9. To observe level of deafness using Audiometer
10. To measure the blood pressure using Sphygmomanometer
11. To demonstrate the working of Heart lung machine
12. To observe the effect of Ultrasound diathermy on subject
13. To measure the nerve conduction velocity using Nerve and muscle stimulator
14. To record the Electromyogram signal at various muscles.

Exp No	Name of the Experiment	Objectives	Key competencies
1	Physioscreen	<ol style="list-style-type: none"> 1. Understand the working of physioscreen. 2. Principle of physioscreen 3. Connect serial port cable (CPU to physioscreen). 4. Subject cables connected to physioscreen 5. Observe various physiological signals 	<ol style="list-style-type: none"> 1. Understand various controls of physioscreen. 2. To perform the experiment as per the procedure 3. Note the readings. 4. Calculations 5. Draws Inferences.
2	Phonocardiogram(PCG)	<ol style="list-style-type: none"> 1. Familiarization with pcg 2. Principle of PCG 3. Identify transducer type 4. Make connections. 5. Measuring heart sounds at different frequencies. 	<ol style="list-style-type: none"> 1. Understand the principle of PCG. 2. To perform the experiment as per the procedure 3. Records reading. 4. Plots wave form 5. Conclusions.
3	Electrosurgical unit(ESU)	<ol style="list-style-type: none"> 1. Familiarization with ESU. 2. Principle of ESU. 3. Identifications of different types of electrodes for ESU. 4. Identify different types of switches. 5. Connect patient plate. 	<ol style="list-style-type: none"> 1. Understands the principle of ESU. 2. To perform the experiment as per the procedure 3. Observe different audio signals for different techniques. 4. Understands the safety precautions. 5. Conclusions.

		<p>6.Perform different techniques on subject using ESU.</p> <p>7.Safety precautions.</p>	
4	Defibrillator	<p>1.To understand the working of defibrillators.</p> <p>2.Principle of defibrillator</p> <p>3.Connect dummy subject to defibrillator.</p> <p>4. Identify types of electrode.</p> <p>5.Identify abnormalities</p> <p>6.Conversion of abnormal to normal by applying various energies using defibrillator.</p>	<p>1.Understands the principle of defibrillator</p> <p>2.To perform the experiment as per the procedure</p> <p>3.Observations</p> <p>Calculate energy for different voltages and capacitor values</p> <p>4.conclusions</p>
5	Short wave diathermy	<p>1.Familiarization with short wave diathermy.</p> <p>2.Principle of short wave diathermy</p> <p>3.Identify electrodes</p> <p>4.Measuring the amount of current and time durations</p>	<p>1,Understands the principle</p> <p>2.To perform the experiment as per the procedure</p> <p>3.Records the readings.</p> <p>4.Observing the effect on subject.</p>
6	Bio-telemetry	<p>1.Identify various modules</p> <p>2.Principle of biotelemetry</p> <p>3.Connections of transmitter and receiver.</p>	<p>1.Understands the principle of biotelemetry</p> <p>2.To perform the experiment as per the procedure</p> <p>3.Records reading at transmitter and from receiver</p> <p>4.Draws Inferences.</p>

		<p>4. Identify type of sensor</p> <p>5. Transmitting signal from the receiver.</p> <p>6. Acknowledge from beep sound.</p>	
7	X-ray machine	<p>1. Familiarization with various controls.</p> <p>2. Principle of X-ray</p> <p>3. Different accessories used in dark room.</p> <p>4. Analyze the circuit connections</p> <p>5. Adjusting of KVA, MA and time of exposure for different positions and organs.</p> <p>6. Safety precautions (Maximum permissible dose)</p> <p>7. Loading film in cassette Image intensifier.</p>	<p>1. Understands and familiarization with front panel controls</p> <p>2. Understands the Principle</p> <p>3. Understands safety precautions</p> <p>4. Conclusion.</p>
8	PACEMAKER	<p>1. Identify various modules</p> <p>2. Principle of pacemaker</p> <p>3. Making connections</p> <p>4. Identify tachycardia and bradycardia and AV block</p>	<p>1. Understands the principle of pacemaker by observing the conversion of waveforms</p> <p>2. To perform the experiment as per the procedure</p> <p>3. Plots the abnormal and normal waveforms</p> <p>4. Conclusion</p>

		5. Stimulate and observe abnormal waveform being converted to normal waveform	
9	AUDIOMETER	<ol style="list-style-type: none"> 1. Identify various modules 2. Know the principle 3. Making connections 4. Measuring level of deafness with masking and without masking 	<ol style="list-style-type: none"> 1. Understand the functions of front panel controls 2. To perform the experiment as per the procedure 3. Records deafness at various levels for various subjects 4. Drawing inferences from the recordings
10	SPHYGMOMANOMETER	<ol style="list-style-type: none"> 1. Identify the parts of the instrument 2. Principle of Korotkoff sounds 3. Placing the cuff on the subject 4. Measuring the blood pressure at various conditions, on different subjects 	<ol style="list-style-type: none"> 1. Understands the operation of sphygmomanometer 2. Records the observations 3. Prepares the Report 4. Draws Inferences from the readings
11	HEART LUNG MACHINE	<ol style="list-style-type: none"> 1. Identify various modules available in heart lung machine 2. Know the principle 3. Assembling the modules in a specific manner to perform the function of heart lung machine 	<ol style="list-style-type: none"> 1. Understands the function of heart lung machine 2. Prepares the report

12	ULTRASOUND DIATHERMY	<ol style="list-style-type: none"> 1. Identify various front panel controls 2. Know the principle Identify the type of transducer used 3. Connecting the transducer cable to the machine 4. Observe the effect on the subject by applying ultrasound waves 	<ol style="list-style-type: none"> 1. Understands the principle of ultrasound diathermy 2. Prepares the Report
13	NERVE MUSCLE STIMULATOR	<ol style="list-style-type: none"> 1. Familiarization with front panel controls 2. Principle of Nerve Muscle stimulator 3. Make the connections 4. Measures the voltages at different limb positions 	<ol style="list-style-type: none"> 1. Understands the principle 2. Records the observations 3. Calculate the conduction velocities for different subjects 4. Prepares Reports 5. Draws inferences from the observations
14	EMG	<ol style="list-style-type: none"> 1. Identify the type of recorder Observe the front panel controls 2. Know the principle of EMG 3. Connect the patient electrode probe 4. Recording EMG signals on different muscles 	<ol style="list-style-type: none"> 1. Understands the principle of EMG 2. Records the EMG signals on different muscles 3. Observes the waveforms 4. Prepares Reports 5. Draws inferences

BIO-MEDICAL SIGNAL PROCESSING LAB PRACTICE

Subject title : **Bio-medical signal processing lab Practice**
Subject code : **BM-608**
Periods per week : **3**
Periods / Semester : **45**

TIME SCHEDULE

SI NO	Major Topics	Periods
1	Acquaintance with matlab software & signal processing toolbox	15
2	Familiarization with signal processing toolbox with various examples	30
3	Practicing compression algorithms	15
	Total	60
	Periods	

List of the Experiments

1. Acquaintance with matlab software
2. Familiarization with signal processing toolbox
3. Generation of sine & cosine waves
4. Generation of square & triangular waves
5. Generation of exponentials
6. Generation of logarithmic
7. Signal averaging
8. Generation of ECG
9. Generation of noisy ECG
10. Filtering an ECG signal from sinusoidal noise trend removal or Noise less ECG
11. FFT of corrupted ECG signal
12. Data compression using AZTEC Algorithm
13. Data compression using TP Algorithm

Exp No	Name of the Experiment	Objectives	Key competencies
1	Acquaintance with Matlab software	<ol style="list-style-type: none"> 1. Know about what is matlab 2. Identifying the matlab icon and able to open it 3. Access command window and signal processing tool box 4. Identify various signal processing commands 5. Understand the commands used for generation of various signals 6. Know how to represent data in form of matrix 7. To clear screen when needed 	<ol style="list-style-type: none"> 1. Write commands in command window and run 2. Generate plots and subplots 3. Perform simple matrix manipulation using matlab.
2	Familiarization with signal processing tool box	<ol style="list-style-type: none"> 1. Know about toolbox 2. To access signal processing tool box. 3. Read the various functions available. 4. Know how to represent data. 	<ol style="list-style-type: none"> 1. Identify various signal processing tools 2. Identify the tool which is suitable for program.
3	Generation of sine, cosine waves	<ol style="list-style-type: none"> 1. Know about sine and cosine function. 2. Know how to give necessary input data 3. Access command window. 4. Resolve the errors. 	<ol style="list-style-type: none"> 1. Able to write command window. 2. Run the programme. 3. Plot the sine wave and cosine wave 4. Know the changes present in the plot due to variation in input data

4	Generation of square and triangular waves	<ol style="list-style-type: none"> 1. Know about square and triangular function. 2. Know how to give necessary input data 3. Access command window. 4. Resolve the errors 	<ol style="list-style-type: none"> 1. Write command on command window. 2. Run the programme. 3. Plot the square wave and triangular wave 4. Know the changes present in the plot due to variation in input data.
5	Generation of exponential signal.	<ol style="list-style-type: none"> 1. Know about square and triangular function. 2. Know how to give necessary input data 3. Access command window. 4. Resolve the errors. 	<ol style="list-style-type: none"> 1. Write command on command window. 2. Run the programme. 3. Plot the square wave and triangular wave 4. Know the changes present in the plot due to variation in input data
6	Generation of logarithmic signals	<ol style="list-style-type: none"> 1. Know about sine and cosine function. 2. Know how to give necessary input data 3. Access command window. 4. Resolve the errors. 	<ol style="list-style-type: none"> 1. Enter commands in command window. 2. Run the programme. 3. Plot the sine wave and cosine wave 4. Know the changes present in the plot due to variation in input
7	Signal averaging	<ol style="list-style-type: none"> 1. Know the necessity of signal averaging. 2. Know the functions available in matlab for averaging. 3. Use suitable functions. 4. Know the syntax. 5. Give inputs which are necessary. 	<ol style="list-style-type: none"> 1. Access command window and write the function for averaging 2. Know averaging variables. 3. Know entering commands for matrix addition multiplication and division. 4. To execute the program and able to draw output plot. 5. Resolve the errors.

8	Generation of ECG	<ol style="list-style-type: none"> 1. Get the ECG data from note pad by saving it in M-file. 2. Create M-file in Matlab . 3. Know the command for generation of ECG in matlab. 4. Know the command for giving labels. 	<ol style="list-style-type: none"> 1. To open command window write the program for generation of ECG. 2. Solve the error. 3. Debug the discrete data present in M-file. 4. Plot ECG. 5. Mark labels for plot.
9	Generation of Noisy ECG	<ol style="list-style-type: none"> 1. Access the ECG data from note pad by saving it in M-file. 2. Create M-file in Matlab. 3. Know the command for generation of ECG in matlab. 4. Know the command for giving labels. 5. Generate a random noise. 6. Know the command for generation of random noise. 	<ol style="list-style-type: none"> 1. Open command window write the program for generation of ECG. 2. Solve the error 3. Debug the discrete data present in M- file. 4. Generate random noise signal by executing its command on matlab command window 5. Write program to add ECG and random noise 6. Plot noise ECG.
10	Filtering an ECG signal from sinusoidal noise trend removal or Noise less ECG.	<ol style="list-style-type: none"> 1. To generate ECG using ECG command. 2. Generate a noise ECG 3. Write syntax for eliminating noise from noisy ECG 4. Know the syntax for subplot. 	<ol style="list-style-type: none"> 1. Open command window write the program for generation of ECG. 2. Solve the error. 3. Debug the discrete data present in M-file. 4. Generate random noise signal by executing its command on matlab command window 5. Write program to add ECG and random noise

			<ol style="list-style-type: none"> 6. Execute the command or logic for generating noise less ECG. 7. Plot the noisy ecg 8. Subplot in which ecg, noisy ecg, noiseless ecg
11	FFT of corrupted ECG signal	<ol style="list-style-type: none"> 1. To generate ECG using ECG command. 2. Generate a noise ECG 3. Write syntax for eliminating noise from noisy ECG 4. Generate noisy ecg or corrupted ecg 	<ol style="list-style-type: none"> 1. Open command window write the program for generation of ECG. 2. Solve the error. 3. Debug the discrete data present in M-file. 4. Generate random noise signal by executing its 5. Execute FFT function on corrupted ECG 6. Resolve the error. 7. Subplot the ECG, corrupted ECG 8. Transformed signal.
12	Data compressing using AZTEC	<ol style="list-style-type: none"> 1. To generate ECG using ECG command. 2. Generate a noise ECG 3. Write syntax for eliminating noise from noisy ECG 4. Know the importance of compressing data 5. Identify the command for data compression using AZTEC. 	<ol style="list-style-type: none"> 1. Open command window write the program for generation of ECG. 2. Solve the error. 3. Debug the discrete data present in M-file. 4. Generate random noise signal by executing its command on matlab command window 5. Calculate the Vth, by writing suitable expression. 6. Write the syntax for calculating various parameter like vth, vmax, vmin. 7. Generate compressed ECG. 8. Subplot ECG and compressed ECG.

BIOMEDICAL CIRCUITS DESIGN & SERVICING LAB PRACTICE

Subject Title : BIOMEDICAL CIRCUITS DESIGN & SERVICING LAB PRACTICE

Subject code : BM-609

Periods/Week : 03

Periods/Semester : 45

TIME SCHEDULE

SI NO	Major Topics	Periods
1	Biomedical circuit design	20
2	Biomedical equipment servicing and troubleshooting	25
	Total	45
	Periods	

BIOMEDICAL CIRCUIT DESIGN LAB

List of Experiments

1. Design of Power Supplies.
2. Design of Isolation Amplifier
3. Design of circuits like oscillators, amplifiers etc.
4. Design of Feedback circuits.
5. Design of Electronic Stethoscope

BIOMEDICAL SERVICING LAB

List of the Experiments

1. Trouble shooting and servicing of ECG Machine
2. Trouble shooting and servicing of Defibrillator
3. Trouble shooting and Servicing of ESU machine
4. Trouble shooting and servicing of Bed side Monitor
5. Design of power supply.
6. Miniproject

Exp No	Name of the Experiment	Objectives	Key competencies
1	Trouble shooting and servicing of ECG machine.	<ol style="list-style-type: none"> 1. Check the power cord continuity 2. Fuse and AC mains 3. Identify the trouble or faults in physical appearance of machine. 4. Open the machine(using of screw driver set) 5. Reverse Engg. - Derive circuit from circuit board and interpretation of circuit diagram. 6. Check for power supply output. 7. Identify different modules and checking for output signal from each module. 8. Identify the fault at board and component level 9. Rectify the problem by replacing the suitable components or board. 	<ol style="list-style-type: none"> 1. Change the power cord if any defaults seen in it 2. Change the fuse and check for the AC mains fault 3. Check for detached wires, short ckt, burnt components etc and rectify as per the problem found physically 4. Assemble the parts as it was after rectifying the problem. 5. Replace the components, boards and motor functioning, stylus problem as per the problem found in circuit tracing. 6. Rectify the problem found in machine to work properly
2	Troubleshooting and servicing of Defibrillator	<ol style="list-style-type: none"> 1. Check the power cord continuity 2. Fuse and AC mains 3. Identify the trouble or faults in physical appearance of machine. 4. Open the machine(using of screw driver set) 5. Reverse Engg. - Derive circuit from circuit board and interpretation of circuit diagram. 6/ Check for power supply output. 7. Identify different modules and checking 	<ol style="list-style-type: none"> 1. Change the power cord if any defaults seen in it 2. Change the fuse and check for the AC mains fault 3. Check for detached wires, short ckt, burnt components etc and rectify as per the problem found physically 4. Assemble the parts as it was after rectifying the problem. 5. Replace the components, boards problem

		<p>for output signal from each module. 8. Identify the fault at board and component level 9. Rectify the problem by replacing the suitable components or board.</p>	<p>as per the problem found in circuit tracing. 6. Rectify the problem found in machine to work properly</p>
3	Trouble shooting and Servicing of ESU machine	<ol style="list-style-type: none"> 1. Check the power cord continuity 2. Fuse and AC mains 3. Identify the trouble or faults in physical appearance of machine. 4. Open the machine(using of screw driver set) 5. Reverse Engg. -Derive circuit from circuit board and interpretation of circuit diagram. 6. Check for power supply output. 7. Identify different modules and checking for output signal from each module. 8. Identify the fault at board and component level 9. Rectify the problem by replacing the suitable components or board. 	<ol style="list-style-type: none"> 1. Change the power cord if any defaults seen in it 2. Change the fuse and check for the AC mains fault 3. Check for detached wires, short ckt, burnt components etc and rectify as per the problem found physically 4. Assemble the parts as it was after rectifying the problem. 5. Check the continuity in foot switch & rectify 6. Replace the components, boards and electrodes as per the problem found 7. Rectify the problem found in machine to work properly

4.	Trouble shooting and servicing of Bed side Monitor	<ol style="list-style-type: none"> 1. Check the power cord continuity 2. Fuse and AC mains 3. Identify the trouble or faults in physical appearance of machine. 4. Open the machine(using of screw driver set) 5. Reverse Engg. -Derive circuit from circuit board and interpretation of circuit diagram. 6. Check for power supply output. 7. Identify different modules and checking for output signal from each module. 8. Check for failure in audio 9. Identify the fault at board and component level 10. Rectify the problem by replacing the suitable components or board. 	<ol style="list-style-type: none"> 1. Change the power cord if any defaults seen in it 2. Change the fuse and check for the AC mains fault 3. Check for detached wires, short ckt, burnt components etc and rectify as per the problem found physically 4. Assemble the parts as it was after rectifying the problem. 5. Replace the loudspeaker if any fault found 6. Replace the components, boards and electrodes as per the problem found 7. Rectify the problem found in machine to work properly
4	Design of power supply.	<ol style="list-style-type: none"> 1. To draw the circuit diagram to generate 5v,9v,12v,dc 2. Know the specifications 3. Collect all components devices and PCB 4. Solder the components on PCB 	<ol style="list-style-type: none"> 1. Report of work done 2. Assemble the circuit 3. Practice soldering the components 4. Implement desoldering 5. Check the output of designed circuit by applying suitable input.
5.	Mini project	<ol style="list-style-type: none"> 1. Select the circuit 2. Identify the circuit specifications 3. Purchase the components as per the specifications 4. To solder the circuit on PCB 	<ol style="list-style-type: none"> 1. Assemble the circuit 2. Practice soldering the components 3. Implement desoldering 4. Check the output of designed circuit by applying suitable input 5. Report of work done

VII SEMESTER

SCHEME OF INSTRUCTION AND EXAMINATION
VII SEMESTER (6 MONTHS)
(IN PLANT TRAINING)

BM - 701 INDUSTRIAL TRAINING

S.NO	Subject	Duration	Items	Max Marks	Remarks
1	BM-701 Practical Training in the Industry	6 Months	1.First Assessment (at the end of 3rd month)	100	
			2. Second Assessment (at the end of 6th month)	100	
			3.Training Report		
			a)Log Book	30	
			b)Record	30	
			4. Seminar&viva-voce	40	
TOTAL		300			

The industrial training shall carry **300** marks and pass marks are **50%**.A candidate failing to secure the minimum marks should complete it at his own expenses. No apprenticeship training stipend is payable in such case

During Industrial training the candidate shall put in a minimum of **90%**attendance.

Six Months In plant Training

OBJECTIVES

On completion of 6 month practical training in Biomedical industries/Hospitals/Electronic and allied industries, the student will be able to:

1.0 Know the Organizational set up from Top Executive to workman level

- 1.1 Know the function of each department/Section
- 1.2 Know the inter- relationships among various departments/Sections

2.0 Know the various Components and Equipment used:

- 2.1 Understand the use of various components in producing a subsection of the end product
- 2.2 Know the end product, its construction/Design, commercial importance, applications

3.0 Understand the various stages of manufacturing hardware products/ Developing of Software products

- 3.1 Understand the design of circuits of various stages/ Software development cycle
- 3.2 Minimizing of the Design of Hardware/Software
- 3.3 Know the handling of the Equipment required for the design/Manufacture of the End product

4.0 Know the parameters/ Specifications of the End product

- 4.1 Design Hardware/Software as per the desired parameters/Specifications
- 4.2 Understand the effect of change in parameters

5.0 Know the Testing of the End product

- 5.1 Know the use of Testing Zigs & Testing Equipment
- 5.2 Know the use of Software tools for testing the End product

6.0 Know the Quality control procedures

- 6.1 Know and perform Quality control tests on the End product

7.0 Know the Troubleshooting of the Equipment/ Software

- 7.1 Know the use of tools necessary for troubleshooting of the Hardware/Software

7.2 Know the Troubleshooting of Hardware

7.3 Know the use of Diagnostic software

8.0 Preparation of The Project Report

8.1 Prepare a project report in the area in which the student has undergone the inplant training

COURSE CONTENTS

Organizational setup

Components and Equipment/Software used

Stages of Manufacturing

Parameters / Specifications

Testing

Quality Control

Troubleshooting

Project report

INPLANT TRAINING SCHEME of valuation / assessment

1. A candidate shall be assessed twice in each spell of Industrial training at the 3rd month and finally before he/she completes the industrial training.
2. The assessment shall be carried out by a committee comprising of representative of the industry where the candidate is undergoing training, a staff member of the concerned section of the polytechnic
3. The assessment at the end of the 3rd and 6th months shall each carry 100 marks for the progress made during the corresponding period of training
4. The remaining 100 marks are allotted as follows for the training record: 30 marks, Logbook 30 marks for record and 30 marks for seminar. These are to be evaluated at the institution.

These are to be evaluated at the institution at the end of training by a committee consisting following staff members

- (1) Head of Section.
- (2) External Examiner preferably from Industry
- (3) Staff member who assessed the student during the Industrial Training.

5. The progress made during end of each assessment will be evaluated on the basis the following parameters

ASSESSMENT SCHEME

S. No.	Name of the Parameter	Max. Marks Allotted for each Parameter
1.	Attendance and punctuality	05
2.	Familiarity with Technical terms	06
3.	Familiarity with tools and material	10
4.	Attitude towards job	07
5.	Manual skills	04
6.	Application of knowledge	10
7.	Problem solving skills	10
8.	Comprehension and observation	04
9.	Safety and Environmental consciousness	03
10.	Human relations	04
11.	Ability to communicate	06
12.	Supervising ability	10
13.	General conduct during the period	06
14.	Maintenance of dairy	15
	Total	100