DETAILED SYLLABI AND CURRICULUM OF

B.VOC (MECHATRONICS)

Directorate of Skill Development& Entrepreneurship

ANNAMALAI   UNIVERSITY

ANNAMALAI UNIVERSITY

Directorate of Skill Development & Entrepreneurship

THREE-YEAR B.VOC. COURSES

FULL-TIME DEGREE COURSE

CHOICE BASED CREDIT SYSTEM

REGULATIONS AND SYLLABUS

1. **Condition for Admission:**

   Candidates for admission to the **First Year** of the **Three-Year B.Voc. Degree Programme** shall be required to have passed the final examination of the plus 2 Higher Secondary Course conducted by the Board of Secondary Education, Tamil Nadu Government or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto, for **direct** admission to the **Second Year of B.Voc programme**, the candidates shall be required to have passed the **One-Year Diploma Programme having the National Skills Qualifications Framework (NSQF) level 5 in appropriate discipline** or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto and for **direct admission to** the **Third year of B.Voc programme** the candidates shall be required to have passed the **Two-Year Advanced Diploma Programme having NSQF level 6 in appropriate discipline** or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

2. **Courses of Study (B.Voc)**
   i.   Airport Operations
   ii. Aqua Culture
   iii. Catering Technology and Hotel Management
   iv. Hospital Instrumentation and Management
   v.   Mechatronics

3. **Eligibility for the Award of Diploma / Advanced Diploma / Degree:**
   A candidate shall be eligible for the award of one-year Diploma if the candidate has satisfactorily undergone the prescribed courses of study of the first year of the three-year **B.Voc. programme** and has passed the prescribed examinations and has earned a minimum of 60 credits.

   A candidate shall be eligible for the award of two-year Advanced Diploma if the candidate has satisfactorily undergone the prescribed courses of study of the first and second year if admitted in the **First Year** of the **Three-Year B.Voc. programme** orthe prescribed courses of study of the second year if admitted directly to **Second Year of the Three-Year B.Voc programme** and has passed the prescribed examinations and has earned a minimum of 120/60 credits as applicable.

A candidate shall be eligible for the award of Degree of B.Voc if the candidate has satisfactorily undergone the prescribed courses of study for all the three years **or** the prescribed courses of study of the second and third year if admitted directly to the **Second Year** of the **Three-Year B.Voc. programme** orthe prescribed courses of study of the third year if admitted directly to **Third Year of the Three-Year B.Voc programme** and has passed the prescribed examinations and has earned a minimum of 180/120/60 credits as applicable.

3. Subject of Study:

The Subjects of study are given in Appendix I. The syllabi for the subjects are given in Appendix II

4. Scheme of Examinations:

The scheme of Examinations is given in Appendix - I.

5. Choice Based Credit System:

The following formula should be used for conversion of time into credit hours.

- ➢ One Credit would mean equivalent of 15 periods of 60 minutes each, for theory, workshops/labs and tutorials;
- ➢ For internship/field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops;
- ➢ For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

Each semester curriculum shall normally have a blend of theory, On-Job Training and practical courses. The total credits for the entire degree course will be 180. For the award of the degree a student has to

1) Earn a minimum of 180 credits,

2) Serve in the NSS or NCC for at least one year, and

3) Enroll as a student member of a recognized professional society.

6. Duration of the Programme:

A student is normally expected to complete the Diploma Programme in one year but in any case not more than three years from the time of admission.

A student is normally expected to complete the Advanced Diploma Programme in two/one year but in any case not more than four/three years from the time of admission as applicable.

A student is normally expected to complete the B.Voc Degree Programme in three/two/one year but in any case not more than five/four/three years from the time of admission as applicable.

7. Registration for courses:

A newly admitted student will automatically be registered for all the courses prescribed for the first Semester without any option.

Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Director, Centre for Skill Development along with a late fee will be done up to the last working day. Registration for the project work shall be done only for the final semester.

8. Assessment:

The break-up of assessment and examination marks for theory subjects is as follows.

First assessment : 10 marks

Second assessment : 10 marks

Attendance : 5 marks

End Semester Examination : 75 marks

The break-up of assessment and examination marks for practical subjects is as follows:

First assessment (test) : 15 marks

Second assessment (test) : 15 marks

Maintenance of record book : 10 marks

End Semester Examination : 60 marks

The project work will be assessed for 40 marks by a committee consisting of the guide and a minimum of two members nominated by the Nodal Officer of the programme along with the Director, Centre for Skill Development. The Nodal officer of the programme along with the Director, Centre for Skill Development will nominate one of the committee members as the Chairman. The Nodal Officer may opt himself/herself be the Chairman. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

9. Substitute assessments:

A student, who has missed for genuine reasons accepted by the Nodal Officer and the Director, Centre for Skill Development, one or more of the assessments of a course other than the examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Nodal Officer within a week from the date of the missed assessment.

10. Student Counselors:

To help the students in planning their course of study and for general advice on the academic programme, the Nodal Officer of the Programme will attach a certain number of students to a member of the faculty who shall function as student counselor for those students throughout their period of study. Such student counselors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Director, Centre for Skill Development.

11. Class Committee:

The composition of the class committees from first to sixth semester will be as follows:

i. Course co-ordinators of the common courses, if any, who shall be appointed by the Director from among the staff members teaching the common course.

ii. A project coordinator (in the sixth semester committee only), who shall be appointed by the Nodal Officer in consultation with the Director, Centre for Skill Development from the project supervisors.

iii. Teachers of individual courses.

One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Director, Centre for Skill Development. The Nodal Officer or Director, Centre for Skill Development may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the first and third assessments and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory/40 marks for seminar/ industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Director for approval and transmission to the Controller of examinations.

12. Withdrawal from the Examination:

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade 'W' appears in the mark sheet for such candidates.

13. Temporary break of study:

A student can take a one-time temporary break of study covering the current semester and/or the next semester only for B.Voc Degree with the approval of the Dean on the recommendation of the Nodal Officer and the Director, Centre for Skill Development, not later than seven days after the completion of the mid semester test. However, the student must complete the entire Programme within the maximum period of five years.

14. Attendance requirements:

To be eligible to appear for the examination in a particular semester, a student must put in a minimum of 75% of attendance in that semester. A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register for and repeat the semester. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

15. Passing and declaration of examination results:

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University as per the UGC guidelines. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average and cumulative grade point average, and prepare the grade cards.

Marks	Letter Grade	Grade Point
96 to 100 marks	Grade 'O' - Outstanding	10
90 to 95 marks	Grade 'A+' - Excellent	9
80 to 89 marks	Grade 'A' – Very Good	8
70 to 79 marks	Grade 'B+' – Good	7
60 to 69 marks	Grade 'B' – Above average	6
55 to 59 marks	Grade 'C' – Average	5
50 to 54 marks	Grade 'P' – Pass	4
<50 marks	Grade 'F' – Fail	Re Appear (RA)
Not appearing	Grade 'AB' - Absent	AB – Absent
Withdraw from	Grade 'W'	W – with drawal

Examination		

A student who obtains less than 30/24 marks out of 75/60 in the theory/practical examination or is absent for the examination will be awarded grade 'RA'.

A student who earns a grade of O, A+, A, B+,B, C or P for a course is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who obtains letter grade RA in a course has to reappear for the examination in that course.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

O - 10; A+ - 9; A - 8; B+ - 7; B - 6; C - 5; P - 4

Courses with grade RA are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for revaluation of one or more of his/her examination answer papers within a week from the date of issue of grade sheet to the student on payment of the prescribed fee per paper. The application must be submitted to the Controller of examinations with the recommendation of the Director, Centre for Skill Development.

After results are declared, mark sheet will be issued to the students. The marksheets will contain the list of courses registered during the semester, the grades scored and the grade point average (GPA) for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester. CGPA is similarly calculated considering all the courses taken from the time of admission.

The results of the final semester will be withheld until the student obtains passing grade in all the subjects of all earlier semesters.

After successful completion of the Programme, the degree will be awarded with the following classifications based on CGPA.

For First class with distinction, the student must earn a minimum of 60/120/180 credits within one / two / three years respectively from the time of admission, pass all the courses in the first attempt and obtain a OGPA of 8.25 or above for all the courses from I to II, I to IV and I to VI semesters respectively for the Diploma / Advanced Diploma / Degree level.

For First class, the student must earn a minimum of 60/120/180 credits within three / five /seven semesters respectively from the time of admission and obtain a OGPA of 6.75

or above for all the courses from I to II, I to IV and I to VI semesters respectively for the Diploma / Advanced Diploma / Degree level.

For Second class, the student must earn a minimum of 60/120/180 credits within three / four /five years respectively from the time of admission for the Diploma / Advanced Diploma / Degree level.

For those students admitted directly to the Second year of B.Voc programme:

For First class with distinction, the student must earn a minimum of 60/120 credits within one /two years respectively from the time of admission, pass all the courses in the first attempt and obtain a OGPA of 8.25 or above for all the courses of III and IV and III to VI semesters respectively for the Advanced Diploma / Degree level.

For First class, the student must earn a minimum of 60/120 credits within three / five semesters respectively from the time of admission and obtain a OGPA of 6.75 or above for all the courses of III and IV and III to VI semesters respectively for the Advanced Diploma / Degree level.

For Second class, the student must earn a minimum of 60/120 credits within three / four years respectively from the time of admission for the Advanced Diploma / Degree level.

For those students admitted directly to the Third year of B.Voc programme:

For First class with distinction, the student must earn a minimum of 60 credits within one year from the time of admission, pass all the courses in the first attempt and obtain a OGPA of 8.25 or above for all the courses of V and VI semesters for the Degree level.

For First class, the student must earn a minimum of 60 credits within three semesters respectively from the time of admission and obtain a OGPA of 6.75 or above for all the courses of V and VI semesters for the Degree level.

For Second class, the student must earn a minimum of 60 credits within three years from the time of admission for the Degree level.

16. Ranking of candidates:

The candidates who are eligible to get the **Diploma / Advanced Diploma / Degree** in First Class with Distinction will be ranked together on the basis of the OGPA for all the courses of study during the period of study.

The candidates passing with First class will be ranked next after those with distinction on the basis of OGPA all the subjects of study during the period of study.

17. Transitory regulations:

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Nodal Officer concerned.

B.Voc (Mechatronics) Three Year degree Course

SEMESTER –I

Code	Subjects	Periods/Week			Exam Duration Hours	Marks		Total Marks	Credits
		L	T	P		CA	FE		
19MTRC101	Communicative English	3	0	0	3	25	75	100	3
19MTRC102	Introduction to Computers	3	0	0	3	25	75	100	3
19MTRC103	Life Coping Skills	3	0	0	3	25	75	100	3
19MTRC104	Mechanical Engineering Basics	3	0	0	3	25	75	100	3
19MTRC105	Technical Drawing Mechanical	4	0	0	3	25	75	100	4
19MTRP106	Language Laboratory	0	0	3	3	40	60	100	2
19MTRP107	Bench Work- Electrical	0	0	3	3	40	60	100	2
19MTRP108	Bench Work- Mechanical	0	0	3	3	40	60	100	2
19MTRP109	Computer Laboratory	0	0	3	3	40	60	100	2
19MTRT110	Skill /OJ Training	0	0	6	3	40	60	100	6
	Total	16	0	18		325	675	1000	30

[L] – Lecture**[T]** – Theory   **[P]** – Practical
[CA] – Continuous Assessment **[FE]** – Final Examination

SEMESTER –II

Code	Subjects	Periods/Week			Exam Duration Hours	Marks		Total Marks	Credits
		L	T	P		CA	FE		
19MTRC201	Soft Skill and Personality Development	3	0	0	3	25	75	100	3
19MTRC202	Materials Technology	3	0	0	3	25	75	100	3
19MTRC203	Technical Drawing – Electrical	3	0	0	3	25	75	100	3
19MTRC204	Manufacturing Methods Basics	3	0	0	3	25	75	100	3
19MTRC205	Electrical Fundamentals	4	0	0	3	25	75	100	4
19MTRP206	Electrical Fitting Automation Laboratory	0	0	3	3	40	60	100	2
19MTRP207	Assembly Technology	0	0	3	3	40	60	100	2
19MTRP208	Soft Skill and personality Development Laboratory	0	0	3	3	40	60	100	2
19MTRP209	CAD/CAM Electrical Laboratory	0	0	3	3	40	60	100	2
19MTRT210	Industrial Training	0	0	6	3	40	60	100	6
	Total	15	0	18		325	675	1000	30

At the end of the each semester, students should compulsory undergo four weeks industrial training and relevant certificate has to be submitted.

SEMESTER –III

Code	Subjects	Periods/Week			Exam Duration Hours	Marks		Total Marks	Credits
		L	T	P		CA	FE		
19MTRC 301	Electronic Devices	3	0	0	3	25	75	100	3
19MTRC 302	Analog and Digital ICs	3	0	0	3	25	75	100	3
19MTRC 303	Basic Thermal Engineering	3	0	0	3	25	75	100	3
19MTRC 304	Manufacturing Process	3	0	0	3	25	75	100	3
19MTRC 305	Autotronics	4	0	0	3	25	75	100	4
19MTRP 306	Electronics Lab	0	0	3	3	40	60	100	2
19MTRP 307	Digital Electronics Laboratory	0	0	3	3	40	60	100	2
19MTRP 308	Mechanics and thermal Engineering Laboratory	0	0	3	3	40	60	100	2
19MTRP 309	Manufacturing Laboratory	0	0	3	3	40	60	100	2
19MTRT 310	Industrial Training	0	0	6	3	40	60	100	6
	Total	15	0	18		325	675	1000	30

SEMESTER –IV

Code	Subjects	Periods/Week			Exam Duration Hours	Marks		Total Marks	Credits
		L	T	P		CA	FE		
19MTRC 401	Pneumatic and Hydraulic Systems	3	0	0	3	25	75	100	3
19MTRC 402	Measurement Systems and Sensors	3	0	0	3	25	75	100	3
19MTRC 403	Metrology and Measurement	3	0	0	3	25	75	100	3
19MTRC 404	Embedded Systems	3	0	0	3	25	75	100	3
19MTRC 405	Industrial Electronics	4	0	0	3	25	75	100	4
19MTRP406	Pneumatics and Hydraulic Laboratory	0	0	3	3	40	60	100	2
19MTRP407	Sensors Laboratory	0	0	3	3	40	60	100	2
19MTRP408	Metrology Measurement Laboratory	0	0	3	3	40	60	100	2
19MTRP409	Microcontroller Laboratory	0	0	3	3	40	60	100	2
19MTRT 410	Industrial Training	0	0	6	3	40	60	100	6
	Total	15	0	18		325	675	1000	30

SEMESTER –V

Code	Subjects	Periods/Week			Credits	Marks		TotalMarks
		L	T	P		CA	FE	
19MTRC 501	Computer Aided Design and Manufacturing	3	0	0	3	25	75	100
19MTRC 502	Industrial Automation	3	0	0	3	25	75	100
19MTRC 503	Mechatronics System Design	3	0	0	3	25	75	100
19MTRC 504	Elective I	4	0	0	3	25	75	100
19MTRE 505	Elective II	3	0	0	4	25	75	100
19MTRP 506	CAD Lab	0	0	3	2	40	60	100
19MTRP 507	Industrial Automation Laboratory	0	0	3	2	40	60	100
19MTRP 508	Mechatronics System Design Laboratory	0	0	3	2	40	60	100
19MTRP 509	Simulation Laboratory	0	0	3	2	40	60	100
19MTRT 510	Skill /OJ Training	0	0	6	6	40	60	100
	Total	16	0	18	30	325	675	1000

SEMESTER –VI

Code	Subjects	Periods/Week			Credits	Marks		TotalMarks
		L	T	P		CA	FE	
19MTRE 601	Elective III	3	0	0	3	25	75	100
19MTRP 602	Apprenticeship Training	0	0	10	16	40	60	100
19MTRT 603	Project Viva Voce	0	0	8	11	40	60	100
TOTAL		3	0	18	30	105	195	300

19MTRC 101 COMMUNICATIVE ENGLISH

Course Objective:

➢ To help students achieve proficiency in English
➢ To develop students professional communication skills to meet the demand in the field of global communication to enable them to acquire placement anywhere with ease and confidence.

Learning Outcomes :

✓ Students enhance their communicative skills in real life situations.
✓ Students will equip with oral and appropriate written communication skills.

UNIT I READING
Definition of reading, Levels of reading- Requirements of reading- Types of reading- Techniques of reading- Academic reading tips- Exercise

UNIT II WRITING
The Sentence, The Phrase, Kinds of Sentences, Parts of Sentence, Parts of speech, Articles-Types of Sentences, Time Management Tips-Test Preparation Tips, Tips for Taking Exams-Construction of Paragraph, Linkage and Cohesion-Academic Essay Writing-Thesis- Report Abstracts- Letter Writing- Memo, Cover Letter, Resume writing- Exercise

UNIT III LISTENING SKILLS
Types of Listening- Objectives- Active Listening- an Effective Listening Skill- Note Taking Tips -Barriers for Good Listening, Purpose of Listening, Outlines and Signposting- Gambits- Exercise

UNIT IV COMMUNICATION SKILLS
Communication Skills -Speaking skills, Definition- Barriers of Communication-Types of Communication-Exercise

UNIT V APTITUDE
Verbal and numerical aptitude-Notes to be made from listening short lectures. Adapting to corporate life- Corporate Etiquette – Grooming and Dressing-Organizing and Attending Meetings – Facing Interviews.

TEXT BOOKS
1. Dhanavel, S.P. "English and Communication Skills for Students of Science and Engineering", Orient Blackswan Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharama, "Technical Communication- Principles and Practice"; Oxford University Press, 2009.

REFERENCE BOOKS
1. LALA, PUSHP and Sanjay Kumar. 'Communicate or collapse: a handbook of effective public speaking, group discussions and interviews'. PHI Learning Pvt. Ltd., 2007.
2. Edgar Thorpe,'Course in Mental Ability and Quantitative Aptitude',Tata McGraw-Hill, 2003.
3. Edgar Thorpe. 'Test of Reasoning', Tata McGraw-Hill,2003.
4. H.M.Prasad,'How to prepare for Group Discussion and Interview'. Tata McGraw-Hill, 2001.
5. Career Press Editors, '101 Great Resumes', Jaico Publishing House,2003.
6. R.S. Aggarwal 'A Modern Approach to Verbal & Non-Verbal Reasoning',S.Chand& Co, 2004.

7. Mishra Sunita and Muralikrishna, 'Communication Skills for Engineers', 1st Edition. Pearson Education, 2004.

19MTRC 102 INTRODUCTION TO COMPUTERS

Course Objective
➢ To familiarize the students with Fundamentals of Computer and IT applications

Learning Outcomes
✓ Students enhance their programming fundamentals
✓ Familiarizing with MS Office
✓ Handle various trends in computer communication

UNIT I INTRODUCTION TO COMPUTERS
Classification, History, Types of Computers. Elements of a Computer System: Block Diagram of The Computer System, Introduction to various units. Hardware: CPU, Memory, Input and Output devices, Auxiliary storage devices. Software: System and Application Software, Utility packages, configuration of Computer System Applications of Information Technology: Wide range of applications in: Home, Education and Training, Entertainment, Science, Medicine, Engineering etc.

UNIT II COMPUTER ACCESSORIES
Input Devices: Mouse, Keyboard, Light pen, Track Ball, Joystick, MICR, Optical Mark reader and Optical Character reader. Scanners, Voice system, Web, Camera.
Output Devices: Hard Copy Output Devices; Line Printers, Character Printers, Chain Printers, Dot-matrix Printers, Daisy Wheel Printer, Laser Printers, Ink jet Printers, Plotters, Soft Copy device-Monitor, Sound card and speakers.
Memory and Mass Storage Devices; Characteristics of Memory Systems; Memory Hierarchy; Types of Primary Memory; RAM and ROM; Secondary and Back-up; Magnetic Disks, Characteristics and classification of Magnetic Disk, Optical Disk, Magnetic Tape.

UNIT III MS WORD
Documentation Using MS-Word -Introduction to Office Automation, Creating & Editing Document, Formatting Document, Auto -text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Advance Features of MS-Word-MailMerge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.

UNIT IV MS EXCEL & POWER POINT
Electronic Spread Sheet using MS-Excel -Introduction to MS-Excel, Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts, Advance features of MS-Excel -Pivot table & Pivot Chart, Linking and Consolidation.
Presentation using MS-PowerPoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

UNIT V COMPUTER COMMUNICATIONS
Introduction, Objectives. Basic of Computer Networks: Local Area Network (LAN), Wide Area Network (WAN). Internet: Concept of Internet, Applications of Internet, Connecting to the Internet, Troubleshooting, World Wide Web (WWW), Web Browsing Software, Popular Web Browsing Software.
Basics of E - mail: What is an Electronic Mail, Email Addressing, Using E - mails: Opening Email account, Mailbox: Inbox and Outbox, Creating and Sending a new E - mail, Replying to an E - mail message, Forwarding an E - mail message, Sorting and Searching emails.

TEXT BOOKS

1. Sinha, P.K. and Priti Sinha, "Computer Fundamentals", BPB, 2016
2. Steven Weikler, Office 2017 for the Begineers, Kindle Publication, 2016

REFERENCE BOOKS
1. Bokhari and Ahmad 'UNIX Operating System', Dhanpat Rai & Co, 2004.
2. Sathish Jain, Kratika and Geetha M, "Office 2010 Course Complete Book For Learning Better And Faster", BPB, 2016.

19MTRC 103 LIFE COPING SKILLS

UNIT I SELF ESTEEM AND PERSONALITY DEVELOPMENT
Self esteem-importance of self esteem- positive self development- self acceptance of strengths and weakness- personality development- methods- do's and don'ts-skills to develop

UNIT II POSITIVE THINKING
Right perception of life- emphasize good things- transform from soft to tough minded individuals- weak to strong men/women

UNIT III MOTIVATION AND GOAL SETTING
Concept of motivation-energizing and directing efforts for goal- enhance motivation desires and aspirations- different types of goals- importance of pursuit of personal goals setting, goals- striving for goals

UNIT IV COPING WITH DEPRESSION, FEAR AND FAILURE
Depression-nature-symptoms and causes- ways to overcome depression- types of failure- understanding failures- handling fear-overcoming failure and fear- understanding anger- hindering anger to achieve goals- coping with failures

UNIT V LEADERSHIP
Leadership- Nature and types- characteristics of good leadership- leadership role courage and confidence.

TEXT BOOK
1. Alphonse, S.J. Xavier,' We shall overcome' ICRDCE publication, Chennai. 5th edition,2011.

REFERENCE BOOKS
1. Dale Carnegie, "The Leader in You", Simon, 2012
2. Robert Heller, "Effective Leadership (Essential Managers)", Dorling Kindersley, 2011
3. Stephen R Covey, "The Seven Habit of Highly Effective People", Kindle, 2015.

19MTRC 104 MECHANICAL ENGINEERING BASICS

UNIT I INTRODUCTION
Systems engineering fundamentals - Machine elements - Power machines - Work machine. Separable joints - Screw threads - Properties and specifications - Classification - Self-locking. Properties and specifications - Design of adhesive joints. Properties and specifications - Lateral press fit joints

UNIT II SCREWS AND LOCKING DEVICES
Standardization - Bolt - screw heads - Properties and specifications - Property classes - Nuts - screw thread - inserts - washers - Standardization - Washers
Locking devices Standardization - Pins - Taper pins - Grooved and slotted pins - Shear pins

UNIT III - SHAFT HUB CONNECTIONS

Standardization - Representation & dimensioning - Keys - key connections - Properties and specifications - Preloaded form fitting joint - Force fitting joint - Clamping elements

UNIT IV CONICAL TAPERS

Taper clamping elements - Standardization - Properties & specifications. Rivets - Blind rivets - Properties and specifications - Riveting techniques / types of rivets - One-sided accessibility

UNIT V SOLDERED CONNECTIONS

Standardization - Open and close joint bonding - Properties - Soldering process - Design / Solder Flux. Standardization - Properties and Classification - Welding processes in the overview - Gas welding - Arc welding - Inert gas arc welding - Microstructure and failure in metal welding

TEXT BOOKS

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", Tata McGraw-Hill, 2009.

REFERENCE BOOKS

1. Thomas Bevan, "Theory of Machines",CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005

19MTRC 105 TECHNICAL DRAWING MECHANICAL

UNIT I INTRODUCTION

Introduction and importance of technical drawing - how designs are engineered into reality - Methods of drawing execution/preparation - there are three methods of preparing a technical drawing - Classification of technical drawing

UNIT II DRAWING

Drawing equipment. Lines - Lettering - Scale Interrupted views. Choice of views - Special views - Adjacent parts and contours - Interrupted views of parts

UNIT III GENERAL PRINCIPLE OF PROJECTION

General principle of projection - Theory of projection - Principal views - Types of projections - System of projection - First angle projection - Third angle projection - Isometric projection - Isometric perspective view

UNIT IVSECTIONED VIEWS

Producing a section - Terms and definitions - General presentation rules - Types of section - Section plane and section path - Basic conventions for sectioning - Class room exercise

UNIT VDIMENSIONING

Dimensioning Basics - Type of dimensions - Dimension - extension and leader lines - Positions of dimensional values - Dimensioning types - Special dimensioning - dimensioning of threads - dimensioning symmetric forms - Representation & dimensioning of threaded parts - Dimensioning of screw Threads - Thread representation in assemblies

TEXT BOOK

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 2010.

REFERENCE BOOKS

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

19MTRP 106 LANGUAGE LABORATORY

1. Improving pronunciation through tongue twisters.
2. Just a minutes session: Speaking Extempore for one minutes on given topics
3. Conversation classes on contemporary issues
4. Reading aloud of newspaper headlines and important articles.
5. Mannerism or Etiquette.
6. Group Discussion
7. Letter drafting
8. Report writing on a topic
9. Writing of corporate CVs
10. PPT presentation on selected issues
11. Tips to face the interviews
12. Mock Interview sessions

19MTRP 107 BENCH WORK - ELECTRICAL LABORATORY

Practical Exposure on

WORK SAFETY - Apply the regulations on work safety in mechanical manufacturing technology
MATERIALS - Different types of materials, Metals, Steel, Plastics and Properties
TOLERANCE - Use in dimensioning and tolerance, General Tolerances, Positive and Position tolerances, Flatness,Parallelism,Perpendicularity,Surface Finish
MEASURING INSTRUMENTS - Subjective testing,Objective testing, Scale Venier Caliper, Universal Protractor, Profile gauge
MARKING - Use hand tools and hand-held machines,Manual marking,marking with a scale,marking angles,marking circles,Centre Punch,Dimensioning
BENDING - SAWING - Bending radius,extended length (Developed length),rolling direction,Spring-back,Hacksaw,Saw blades, Jigsaw
PLANING/GRINDING - Bench grinder,trimming of thegrinding wheels,Protective casings/devices,cooling,Band/belt grinding machine,
DRILLING - Drill press,Hand drill,Drills and Counterbores,
ADHESIVE BONDING - Applications, Advantagesdisadvantages,Work sequences,Load cases,Load calculation,Prepare adhesive, Adhesive bonding,curing
REVIEW - Use hand tools and hand-held machines - Metal material - Plastics - Adhesive bonding - Manufacturing documents - Screwed joints - Fastening elements - Assembly documents - Tools - Standards
MANUCTURING DOCUMENTS - Interpreting manufacturing documents,Assembly drawing,Bill of materials (BOM),Component drawing,Dimensional tolerances,Work schedule (operation plan),Example of a work schedule (Operation plan, Tool list)
SCREWED JOINTS - Interpreting mechanical fastening elements

STANDARDS - Knowing the basics of the standards-extract,Machinery and equipment required

19MTRP 108 BENCH WORK -MECHANICAL LABORATORY

Practical Exposure on

INTRODUCTION AND SAFETY - Accident Safety - First aid - Rules for work safety

FILES AND FILING - Introduction - Types of files - Filing - Tooth shapes - Grades of files - Needle files - Holding the file - Methods of filing - Specification of file - Practical tips - Filing radii - Shape and position tolerances

WORK HOLDING DEVICES - Types of work holding devices - Vices - Clamps

HAND TOOLS - Hand tools - Cutting tools - Hack sawing - Blades - Assembly tools - Spanner - Plier - Wrench

MARKING TOOLS - Types of marking tools - marking support tools - Grades of surface plates - Angle plate - V-Block - Linear marking tools - Scriber - scribing block or Universal surface gauge - Divider - Punches - Number / Letter punch - Marking media

MEASURING INSTRUMENTS AND GAUGES - Test - Classification - Subjective testing - Objective testing - Types of measuring instruments & gauges - Steel rule - Vernier caliper - Gauges - Plug gauges - Plain ring gauge - Snap gauge - Radius gauge - Feeler gauge - Spirit level - Precision measuring instruments - Depth gauge or Depth Vernier caliper - Vernier height gauge - Micrometer - Angle measuring instruments - Universal bevel protractor - Dial indicator - Classroom exercise - Limit gauges - Optical measuring devices - Ultrasound - Calibration of measuring instruments - Measurement error - Vernier - Parallax in the Vernier - Dimensional reading

DRILL AND DRILLING MACHINES - Drill - Drill holding devices - Tool steels - cutting materials - Red-hardness - Drilling Machines - Tapping - Tap Wrenches - tap wrenches - Machine taps - Reaming - Die & Die stock

SCREW THREADS - A brief history of Screw threads - Types of Screw threads - Applications of screw threads

COOLANT AND LUBRICANT - Coolants - Lubricant - Selection of coolants and lubricants - Methods of Lubrication - Coolant care

SURFACE ROUGHNESS - Methods of expressing surface finish - Surface finish standard

LIMITS - FITS AND TOLERANCE & GEOMETRICAL TOLERANCE - Mass production - Systems of Limits and Fits - Fit - Fit system

FINISHING OPERATIONS - Honing - Methods of Honing - Safety Precautions - Lapping - Lap materials - lapping methods - Scraping - Originating of reference surface

WORK METHODOLOGY & PROCESS PLANNING - The 6-step model - 1Inform - 2Plan - 3Elect - 4Render - 5Check

19MTRP 109 COMPUTER LABORATORY

1. Different components of Taskbar
2. Create Desktop icons & Folder and Files on Desktop
3. Run Application such as Notepad, MS Paint
4. Change Mouse properties in Windows

5. Connecting to the Internet, applying browsers software such as chrome, Internet Explorer
6. Applying software download
7. Create E-mail ID in a mail server, sending E-mail and working with Inbox
8. Create Bio data in word
9. Formatting text in Word
10. Create excel database, apply auto sum
11. Create presentation file with multiple slides
12. Apply slide transition and animation
13. Importing and exporting of files
14. Conversion of file from one format to other (.doc to pdf, .jpeg to pdf, etc)

19MTRT 110 ON JOB TRAINING

19MTRC 201 SOFT SKILL AND PERSONALITY DEVELOPMENT

Course Objective

➢ To enhance holistic development of students and improve their employability skills.

Learning Outcomes
✓ Enhance the students Communication ability
✓ Developing the professionals with idealistic, practical and moral values.
✓ Enhance their inter personal skills and be an effective goal oriented team player.

UNIT I LISTENING SKILLS
Barriers to listening; effective listening skils; feedback skills. Attending telephone calls; note taking. Activities: Listening exercises - Listening to conversation, News and TV reports. Taking notes on a speech / lecture.

UNIT II SPEAKING AND CONVERSATIONAL SKILLS
Components of a meaning full and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics. The study of sounds of English, stress and intonation. Situation based Conversation in English.

UNIT III ESSENTIALS OF SPOKEN ENGLISH
Activities, Making conversation and taking turns, Oral description or explanation of a common object, situation or concept, giving interviews.

UNIT IV PRESENTATION SKILL
Oral Presentation with / without audio visual aids. Group Discussion. Listening to any recorded or live material and asking oral questions for listening comprehension.

UNIT V PERSONALITY DEVELOPMENT
Attitude :Factors influencing Attitude, Challenges and lessons from Attitude. Change Management: Exploring Challenges, Risking Comfort Zone, Managing Change. Motivation: Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

TEXT BOOKS

1. Fredrick H. Wentz, "Soft skills Training - A workbook to develop skills for employment", Createspace, 2012.
2. Barun K. Mitra, "Personality Development and Soft skills", Oxford University Press, 2016.

REFERENCE BOOKS
1. Covey Sean, "Seven Habits of Highly Effective Teens", Fireside Publishers, 1998.
2. Carnegie Dale, "How to win Friends and Influence People", Simon & Schuster, 1998.

19MTRC 202-MATERIALS TECHNOLOGY

UNIT I INTRODUCTION

Production and selection of materials - Characteristics of material - Physical characteristics - Mechanical characteristic - Manufacturing characteristic - Chemical characteristics - Corrosion behavior - Recyclability - and danger to the environment and people - Structure of metals - Formation of the metal structure - Classification of materials

UNIT II STEEL

Steel production - Production of pig iron in blast furnaces - Accompanying and alloying elements of steels and iron casting materials - Classification - standardization and characteristics of steel - Summary and areas of application - Structural grade carbon steel - Quenched and tempered steel - Machining steel - Case hardened steel - Nitriding steel - Spring steel - Tool steels - Cold work steel - Hot work steel - High speed steel - Heat treatment of steel.

UNIT III CAST FERROUS MATERIALS

production and materials overview - cast ferrous materials - classification and standardization - cast iron - summary and areas of applications - cast iron with scaled graphite - cast steel

UNIT IV NONFERROUS METALS

ores and extraction methods - overview of types of ores - light metals - classification & standardization of aluminium and aluminium alloys - magnesium alloys - titanium alloys - light metals and their application - heavy metals & extraction - copper & copper alloys - classification and standardization - overview of copper alloys

UNIT V OTHER MATERIALS

Classification & standardization - Production and characteristics - Hard metals

Production and characteristics - Examples of ceramic components - Characteristics of some ceramic materials

Classification and standardization - Materials - properties - applications - Chemical composition and production - Characteristics properties - classification and internal structure - Thermoplastics - duroplaste (duromere) - Epoxy resin - Elastomers – Shaping. Classification and structure of composite material. Lubricants - schematic production process of mineral oil-raffinates - characteristics viscosity - types of coolants and lubricants. material testing -purpose / procedure - procedure (overview) - force analysis

TEXT BOOK

1. William D. Callister, " Materials Science and Engineering, an Introduction", John Willey and Sons Inc. Singapore.

REFERENCE BOOK

1. V. Raghavan, "Physical Metallurgy: Principle and Practice", Prentice Hall India Pvt Ltd.

19MTRC 203TECHNICAL DRAWING – ELECTRICAL

UNIT I ELECTRICAL SYMBOLS
Introduction To Electrical Drawing -Resistors - Capacitors - Power Supplies - Grounding - Output Devices - Switches - Switchgears - Wires and Connections - Diodes - Transistors - Thyristors - Audio and Radio Devices - Meters and Oscilloscope - Machines - Transformers - Power Converters - Logic Gates

UNIT II TYPES OF DRAWINGS
Circuit diagram - wiring diagram - Wiring schedule - Block diagram - Parts list (Bill of Materials BOM) - Single Line Diagram (SLD). Power & Control Circuits

UNIT III SIMPLE CIRCUITS
Simple domestic Lighting & services circuit - Typical Stair Case lighting circuit - Typical Domestic Power Circuit - Typical fan regulator circuit - Typical Tube light Circuit - Ceiling Fan circuit

UNIT IV - STARTER DIAGRAMS
Motor Reversal Circuit - Star-delta starter - Plant SLD and System Overview.
Software for drawings-AutoCAD – Electrical - Solid works – Electrical - EPLAN Electric P8 - Electronic Work Bench - PSPICE - OrCAD

UNIT V - ACTUATORS SYMBOLS
Directional Control Valves - Methods of Actuation - Valves - Linear Pneumatic actuators - Rotary Pneumatic actuators - Auxiliary symbols

TEXT BOOKS

1. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint, 2013

REFERENCE BOOKS

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.
2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.

19MTRC 204-MANUFACTURING METHODS BASICS

UNIT I MANUFACTURING PROCESS
Classification Of Manufacturing Methods. Choice of manufacturing process - Certification - Manufacturing systems. Production logistics - Lead times in production and assembly - Reducing the lead time - Value chain. Changing the material properties - overview of processes - practical example: swiss metallic peeler

UNIT II MATERIALS MANAGEMENT
Material management - Introduction to materials management - Objects of material management - Tasks of material management - Material procurement - Procurement types - Just-in-time procurement - Material management - Stock keeping - Warehouse types

UNIT III PROTOTYPES

Prototypes overview of processes - Compression forming - Forging - Swaging - Extrusion - Impact extrusion - Associated tool kit - Deep drawing - Cutting - Punching - The punching process - Comparison of cost effectiveness - Contact free cutting - Cutting parameters (ISO 9013) - Comparison of processes - Thermal cutting - Plasma cutting (ISO 9013) - Laser cutting (ISO 9013) - Water jet cutting - Machining with geometrically defined blades - Drilling - Tapping - Calculating the cutting speed vc and rpm n - Costing - Metal removal

UNIT IV JOINING

Overview of processes - Joining using prototypes - transporting gas cylinders - setting up the cylinders - Connecting the cylinders - Arc welding - Metal shielding gas welding - Soldering process - Adhesive bonding. Coating -overview of processes - Coating in molten state - Thermal spraying - metal spraying - Powder coating (DIN 56 633) - Coating processes - Enameling - Coating in gas or vapor state - Blackening

UNIT V MEASUREMENT AND TESTING

Testing methods - Measurement errors - Reasons and types of measurement errors - Capability of the measuring instrument - Measuring instrument - Accuracy of Dial gauge - Handling - Lever type dial gauge - Depth micrometer - Measuring gauges for special applications - Material - Optical measuring instruments - Ultra Sound - Infrared - Laser - Limit gauges - Caliper gauges - Screw pitch gauges - Threaded gauge ring - Deviations in the shape - Surface roughness tester

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice- Hall of India Private Limited, 2007.

REFERENCE BOOKS

1. SeropeKalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4 th Edition, Pearson Education, Inc. 2007.
2. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16th Edition, 2001.
3. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Adithan. M and A.B. Gupta, "Manufacturing Technology", New Age, 2006.

<div align="center">

19MTRC 205 ELECTRICAL FUNDAMENTALS

</div>

UNIT I ELECTRIC CURRENT AND VOLTAGE.

Structure of matter - Electric current in metals - The electrical circuit - Effect of electric current - Types of current - Strength of current - Direction of current - Measurement of current - Differences between DC and AC - Electric charge - Static Electric charge Voltage - Voltage unit - Voltage generation: Measurement - Electrochemistry - Electrolysis - Applications of electrolysis - Galvanic primary element - Standard electrode potential - Electrochemical corrosion - Galvanic secondary element - Internal resistance of a voltage source - Internal resistance of a battery - Connecting of voltage sources

UNIT II ELECTRICAND MAGNETIC FIELD

Effects of force - Electric field strength - Dielectric strength - Electric lines of force - Induction - Shielding of electric fields.

Fundamentals - Ferromagnetic materials - Magnetic pole - Magnetization - Demagnetization - Images of lines of force - Electromagnetism - Magnetic measures and units - Magneto motive force and field strength - Magnetic Flux - Magnetic resistance - Magnetic circuits - Magnetic effects of force - Electromagnetic components - Applications of electromagnets - Solenoid in a magnetic field

UNIT III ELECTRICAL PARAMETERS

Conductivity - Electrical resistance - Electrical conductance - Measurement of electrical resistance - Specific resistance - Electrical conductivity - Resistance and Temperature - Coefficient of temperature - Computation of resistance - Resistors and their types - Color Coding - Ohm's law - Resistive Circuits - Law on series connection - Line voltage drop - Law on parallel connection - Mixed circuits - Voltage divider

Structure of a Capacitor - Properties of a capacitor - Capacitance of a capacitor - Energy stored in a capacitor (Work) - Capacitance of a plate capacitor - Absolute permittivity and relative permittivity - connecting of capacitors - Series and parallel connection - the capacitor in a DC circuit - Charging and discharging process in a capacitor - Types of capacitors

Measurement range extensions - Voltmeter - Ampere meter - Bridge circuit - Indirect measurement of resistance

UNIT IVELECTRICAL SAFETY

Effects on the human body - Reactions of the body to currents - Fault types - Protection against over-current - Dealing with electrical accidents - Personal Protective Equipment (PPE). Energy - Temperature - Specific heat capacity - Thermal efficiency - Electric heat and Useful heat - Electric power and Useful heat - Application of electric heat

UNIT VELECTRIC POWER AND WORK

Power - Work & Energy - Measurement of electric power - Connection of a Wattmeter - Adjustment of power - Influence of the load resistance on the power - Power Efficiency - Electric work - Measurement of electric work (Energy) - Measurement of power using a kWh-meter

TEXT BOOKS
1. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.

REFERENCE BOOKS
1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
3. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, 2003.

19MTRP 208 SOFT SKILL AND PERSONALITY DEVELOPMENT LABORATORY

1. Classroom technique to improve the soft skills
2. Surprise writing on current issues
3. General grooming sessions to face the interview
4. Group discussions

5. Motivational classes to improve communication and confidence power
6. Team project on personality development
7. Presentation through visual aids
8. News reading
9. Dialogue delivery
10. Change project

19MTRP 206-ELECTRICAL FITTING AUTOMATION LABORATORY

Practical Exposure on

SAFETY MEASURES
Protective measures - Residual current protective device - Setup - Operating conditions - Protective insulation - Safety separated circuits - Protective earthing - Explanation of terms - Conductor symbols - Working on electrical equipment - High voltage equipment - Mistakes

FIRST AID
Dangers of electric current - Term definitions - what to do in an emergency - ABCD plan very dangerous - Burns - Bleeding - Shock - Measures for saving personnel during electric accidents

CONDUCTORS AND CABLES
Conductor materials - Conductor types - Bus bars - Wire - plastic and enamel insulated - Cable - Strand - Cable types - Equipment cable - Optical fiber - Bus cable - Conductor colors

PASSIVE COMPONENTS
Color table for resistance value and tolerance - Resistance value series - Basic symbols - PTC Thermistors - Power resistors

TERMINALS & PLUGS
Spring-type terminal - Direct clamping - Terminal blocks - Special types of terminal blocks - Installation instructions and wiring of terminal blocks - Rules for terminal descriptions - Device terminals - Network terminal - PCB terminal - Plug-in type screw terminals - Connectors in controller design - Construction of a connector

CONTROL AND SIGNALING DEVICES
Switches and push buttons - Terminal designation for the switch - Colors and symbols for the push button - Color type - Signal lamps - Characteristics of signal lamps - Types of signal lamps - Lamp socket - Colors for signal lamps - Lamp socket - Relays - Terminal designation for relays and contactors - Delayed action relay - Terminal designation for delayed action relay - Relay socket

SWITCHING AND PROTECTIVE DEVICES
Contactors - Fuses - Micro fuses - Color marking - Low voltage high power fuses - Replacement of fuse cartridges (fusible) - Tripping characteristic - Residual current protective device - Motor protection switch - Motor protection relay

TOOLS
Cutting tools - crimping of conductor ends - Strip the insulation - Stripping

ASSEMBLING
Types of screwed joints - Shape of crimp sleeves - Crimp shapes - Crimping tools - Check the joint - Types of assembly - Bucket assembly - Door / shelf wiring - Cable assembly - Earthing

SOLDERING

Soldered joints - Soft solders - Soldering machines - Solder tips - Common soldering alloys - Soldering process - Testing the soldering joint - Electrostatic discharge - Protective measures - ESD-protected workplace - ESD-sensitive components - Preparation of components - Bending of connecting wires - Distancing from the PCB - Circuit boards - Assemble components - Insulated assembly - Assembling tools - Gripping tweezers - IC assembly & de-assembly tools - Cutting of components - Cutting tools - de-soldering

ELECTRICAL MEASURING INSTRUMENTS
Voltmeter - Ammeter - Wattmeter - Megger

ELECTRONIC COMPONENTS TESTING
Code letters - Diodes - Bridge rectifier - Zener-diodes - Bipolar transistors - Housing types – Thyristors - Integrated circuits

TRANSFORMERS
Single-phase transformers - Installation and connection of single-phase transformers

WIRING
Circular bundled wiring - Cable conduit wiring - Flat cable wiring - Mechanical strength - Electrical criteria - Letter identification - Types of wiring - Laying the cables - Fixing the cables - Wiring procedure - Visual inspection - Earth conductor system - Procedure

COMPONENT MOUNTING
Electrical component mounting

QUALITY STANDARDS
Demand-based pricing

19MTRP 207 ASSEMBLY TECHNOLOGY LABORATORY

PRACTICE ON JOINING COMPONENTS WITH SEPARABLE JOINTS
Assembly tools - equipment and accessories - Classification of joining methods - Basics of Screwed Joints - Loading cases - Decrease in preload force - Functioning - Screws - Classification based on head shape - Classification based on shaft shape - Nuts - Other types of nuts - Types of nut - Strength category of screws - Tightening torque - Thread depth - Practical tips - Washers - Screw locking mechanisms - Locking arrangements for nuts - Types of pins - Fastening pins - Cylindrical pins - Taper pin - Shear pin - Fixing pins - Grooved pins - Spring pins - Work sequence for a cylinder pin joint - Dismantling - Threaded inserts made of wire - Installation of threaded inserts - Plastic threaded inserts

BONDING OF COMPONENTS
Adhesive bonding - Applications - Advantages and disadvantages - Work sequence - Preparing the bonding surfaces - curing process - Preparing the adhesive - Adhesive bonding - Curing

JOINTS AND BEARING
Distinguishing joints - Form fitting joints - Parallel key formation - Wedge profile - Bearing - Function of bearings - Distinction - Sliding bearings - Hydrodynamic sliding bearings - Hydrostatic sliding bearings - Roller bearings - Comparison with sliding bearings - Roller bearing - designation - Basics of roller bearings - Basics of sliding bearings - Installation of roller bearing in cold condition - Spherical roller bearings - Spherical ball bearings - Tools for assembling & dismantling roller bearings - Lubricating roller bearings - Installation of roller bearing in hot condition - Dismantling roller bearings - Tools for dismantling - Causes for bearing failure - General care & maintenance of bearing - Seal types (based on DIN 3750)

DIAL INDICATORS

Dial gauge - Handling - Test Indicators - Handling - Checking the perpendicularity - Shape and positional tolerances - Checking the flatness - Checking the radial concentricity - Checking the axial concentricity - checking concentricity - Checking the symmetry

COUPLING

Coupling - Maintenance of coupling - Reasons for failure of coupling

FITS AND GENERAL TOLERANCES

Types of fit - Principles and concepts of general tolerancing

BELT AND GEAR DRIVE

Belt drive - Function of the belt drive - Distinction - Force fitting belt drive - Types of belts - V-belts - V belt drive - Alignment of the v-belt pulley - Timer belt drive - Belt fasteners - Care & maintenance of belts - Maintenance features of the V-belt - Installation of belt drive - Alignment of shafts - Gears - Backlash

CHAIN DRIVE

Chain drive - Chain link - Springs - damping elements - Damping in Machine tools - Effect of vibration on Machine tool

GUIDING MECHANISM

Lubrication of sliding guides - Sliding guides with Hydrostatic lubrication - Sliding guides with hydrodynamic lubrication - Threaded ball screw - Mounting of ball screws - Influence of ball screw mounting errors - Type of ball nut - Method of supporting screw end - Wear adjustment facilities - Adjustment of gibs in lathe - Tail stock assembly - Wiper pads - End gearing and backlash - Checking the backlash - Backlash adjustment in cross slide - Testing of machine tools - Test Mandrels (Test bars) - Types of mandrels - Straight edge

19MTRP 209 CAD/CAM ELECTRICAL LABORATORY
19MTRT 210 INDUSTRIAL TRAINING

19MTRC 301 ELECTRONIC DEVICES

UNIT ISEMICONDUCTOR DIODES AND APPLICATIONS

Introduction, Semiconductor Materials - Ge, Si, and GaAs, Covalent Bonding and Intrinsic Materials, Energy Levels, n-Type and p-Type Materials, Semiconductor Diode, Resistance Levels, Diode Equivalent Circuits, Transition and Diffusion. Capacitance, Reverse Recovery Time, Diode Specification Sheets, Semiconductor Diode Notation, Diode Testing, ZenerDiodes, Light-Emitting Diodes, Sinusoidal Inputs; Half-Wave Rectifier, Full-Wave Rectifier, Clipper, Clamper, ZenerDiode, Voltage-Multiplier Circuits, Practical Applications

UNIT II BIPOLAR JUNCTION TRANSISTORS

Introduction, Transistor Construction, Transistor Operation, Common-Base Configuration, Common-Emitter Configuration,Common-Collector Configuration, Limits of Operation, Transistor Specification Sheet, Transistor Testing, TransistorCasing and Terminal Identification

UNIT III FIELD EFFECT TRANSISTORS

Introduction, Construction and Characteristics of JFETs, Transfer Characteristics, Important Relationships, Depletion-TypeMOSFET, Enhancement-Type MOSFET, MOSFET Handling.

UNIT IV VOLTAGE REGULATORS

Introduction, General Filter Considerations, Capacitor Filter, RC Filter, Discrete Transistor Voltage Regulation, IC VoltageRegulators.

UNIT V SPECIAL PURPOSE DEVICES

Introduction, Silicon-Controlled Rectifier, Basic Silicon-Controlled Rectifier Operation, SCR Characteristics andApplications, Shockley Diode, Diac, Triac, Unijunction Transistor, Phototransistors, MISFETs, MESFETs, TFETs,HEMTs, Silicon Nano Wire Transistor.

TEXT BOOK:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Edition, 2013.

REFERENCE BOOKS:

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill, 2010.
2. David A Bell, "Fundamentals of Electronic Devices and Circuits", Oxford Press, 2009.
3. B L Theraja, R S Sedha, "Principles of Electronic Devices and Circuits", S.Chand, 2004.

19MTRC 302 - ANALOG AND DIGITAL ICs

Course Objective

➢ To acquire the knowledge about the characteristics and operation of various analog and digital ICs

Learning Outcomes

✓ Students equip with design of analog circuits
✓ Understand the digital logic circuits and sequential circuits

UNIT I OPERATIONAL AMPLIFIERS

The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth- equivalent circuit of an op-Amp – virtual ground concept – Linear applications of op-amp –inverting and non-inverting amplifier, summing, subtracting, averaging amplifier - voltage to current converter – current to voltage converter – Differential amplifiers – differentiator and integrator. Non-linear applications – comparator - Schmitt Triggers – Precision diode half wave and full wave rectifiers – Average detectors – peak detector

UNIT II ACTIVE FILTERS AND SIGNAL GENERATOR

Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters (notch filters). Oscillators - RC Phase shift and Wein-bridge. Waveform generators - Square, triangular and saw tooth.

UNIT III TIMER, PLL AND DATA CONVERTERS

555 Timer (internal diagram) and its applications – monostable multivibrator, astable multivibrator. Phase Locked Loop (565 - block diagram approach) and its applications - Frequency multiplication, Frequency translation, voltage to frequency and frequency to

voltage converters. DAC – Binary weighted DAC and R-2R DAC. ADC – single slope and dual slope ADCs, successive approximation ADC

UNIT IV NUMBER SYSTEMS AND LOGIC GATES

Decimal, Binary, Octal and Hexadecimal Numbers.-Conversion between these number systems.-Complements: rs and (r-1)s complements.- subtraction using complements – Encoding number and characters using Binary digits. –Binary Coded Decimal –Gray code - Binary to Gray code conversion –ASCII Code. Logic gates – Truth tables – NOT, AND, OR, NOR, NAND, XOR, XNOR - Boolean Laws and theorems – Solving Boolean expressions, Truth Tables and Logic circuits – The Karnaugh Map – half adder, full adder, Multiplexers and De-multiplexers -Decoders and encoders. Coding of Combination Circuits in Verilog.

UNIT V REGISTERS AND COUNTERS

Flip Flops – RS, D, T, and JK Flip Flops –Characteristic equations, exciting tables – JK Master –Slave flip-flop – Universal shift register. Design of modulo-N counters – counter design using state diagram- sequential circuit design with Verilog.

TEXT BOOKS:

1. Ramakant A. Gayakwad , "Op-amp and Linear ICs", Prince Hall, 1994
2. Morris Mano M , "Digital Logic and Computer design", Prentice Hall 1994.

REFERENCE BOOKS:

1. Robert B.Northrop, 'Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation', CRC Press, 2004.
2. Sergio Franco, 'Design with Operational Amplifiers and analog Integrated circuits', Tata McGraw-Hills, 2002.

19MTRC 303 Basics of Mechanics and Thermal Engineering

UNIT I

Basic Concepts: Thermodynamic system, properties, process, cycle – Zeroth law and temperature measurement-Energy interactions: Types of work transfer and modes of heat transfer. First Law of thermodynamics: Closed system undergoing a process and cycle- Internal energy and specific heats. Open system: Steady and unsteady flow, steady flow energy equation for nozzle, turbine, compressor, turbine and throttling device.

UNIT II

Second Law of thermodynamics: Kelvin Planck and Clausius Statement – Heat engine, refrigerator, Heat pump – Carnot and Reversed Carnot Engine – Efficiency and COP calculations. Concept of irreversible process and entropy.

UNIT III

IC Engines: classification, working principle with auxiliary systems, performance calculation. Reciprocating air compressor: single stage air compressor- working-work done with and without clearance volume – volumetric efficiency.

UNIT IV

Basic Concepts of Fluid Mechanics: Concept of fluid - Dimensions and Units- Properties of Fluids: Pressure, Density, Specific Gravity, Viscosity, Surface Tension, Capillarity, Compressibility and Bulk Modulus. Fluid Statics: Pressure at a Point: Pascal's Law – hydrostatic law –U- tube manometer and pressure gauge.

UNIT V

Fluid Kinematics: Types of flow – Velocity and Acceleration of a fluid particle – Continuity Equation in Cartesian Co-ordinates and discharge -Laminar and turbulent flow – Significance of Reynolds Number. Fluid Dynamics: Bernoulli's Equation - Euler's

Equation for Motion - Applications of Bernoulli's Equation, Venturimeter and Orifice meter.

Text Books
1. Yunus A. Cengel and Michael A. Boles, "Thermodynamics: An Engineering Approach", 7th Edition, McGraw Hill Education (India) Private Ltd., 2011.
2. Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Rothmayer, "Fluid Mechanics", Seventh Edition, Wiley India Pvt. Ltd, 2015.
Reference Books
1. Rayner Joel, 'Basic Engineering Thermodynamics in SI units', ELBS, 1998.
2. Nag, P.K., 'Engineering Thermodynamics', Tata McGraw Hill, 2013.
3. Venkatesh, A., 'Basic Engineering Thermodynamics', University Press, 2007.
4. Richard E. Sonntag, Claus Borgnakke, Gordon J. Vanwylen, 'Fundamental of Thermodynamics', Wiley, 2002.
5. S. K. Som, G. Biswas, Suman Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Third Edition, Tata McGraw - Hill Publishing Company Limited - New Delhi, 2011.
6. Yunus A. Cengel, John M. Cimbala, "Fluid Mechanics: Fundamental and Applications", Third Edition, McGraw-Hill Education (India) Pvt. Ltd, 2014.

19MTRC 304 MANUFACTURING PROCESS

Syllabus (Working principles, Basic operations & Applications only)
UNIT I
Metal Casting Processes: Expendable mould Casting Processes -Sand Casting – Shell moulding – Plaster Mould casting – Ceramic mould casting – Investment casting – Permanent Mold casting Processes – Slush casting – Pressure casting - Die casting - Centrifugal casting.
UNIT II
Metal Forming Processes: Flat Rolling – Flat Rolling Practice –Rolling Mills – Shape Rolling operations – Production of seamless tubing and pipe – Forging –Open die forging – Impression Die and Closed die forging – Related forging operations – Extrusion - Hot extrusion – Cold extrusion – Impact extrusion – Hydrostatic extrusion and Rod and Wire Drawing. Sheet metal forming Processes: Shearing – Sheet Metal characteristics – Bending sheet and plate and Cup Drawing.
UNIT III
Metal Joining Processes: Fusion Welding Processes-Oxy Acetylene welding - Arc welding processes: Consumable Electrode and Non consumable Electrode – Electron Beam Welding – Laser Beam Welding. Solid State Welding Processes:- Ultrasonic welding – Friction welding – Resistance welding.. Brazing, Soldering: Introduction to Brazing and Soldering

UNIT IV
Machining processes for producing Round shapes: Capstan and Turret Lathe – Horizontal Boring Machine – Radial Drilling Machine. Machining processes for producing various shape: Horizontal Milling machine – Shaper – Horizontal Broaching machine.
UNIT V
Abrasive machining and finishing processes: Abrasives – Bonded Abrasives (Grinding Wheels) – Cylindrical Grinding Machine - Surface Grinding Machine - Lapping – Honing

– Super finishing.Non-Conventional machining Introduction - Classification of the machining processes- Electric discharge machining (EDM).

Text Books
1. SeropeKalpakjian and Steven R.Schmid, "Manufacturing Engineering and Technology", Sixth Edition, PHI, 2010.
2. Mikell P.Groover "Fundamental of Modern Manufacturing", Wiley India Edition, Third Edition, Reprint, 2012.

Reference Books
1. E. Paul DeGarmo, J. T. Black and Ronald A. Kohser, "Degarmo's Materials and Processes in Manufacturing ", John Wiley & Sons, 11th Edition 2011.
2. Philip F. Oswald, and Jairo Munoz, "Manufacturing Process and systems", John Wiley India Edition, 9th Edition, Reprint 2008.
3. P.N.Rao, "Manufacturing Technology", Volume-2, Tata McGraw Hill, New Delhi, Third Edition, 2011.
4. P.C. Sharma, "A Text Book of Production Technology (Manufacturing Processes)", S. Chand & Company Ltd., New Delhi, Seventh Reprint, 2012.

19MTRC 305 AUTOTRONICS

UNIT I
Automotive fundamentals: The engine-components-Drive train -Starting & charging systems operation-Ignition system- Suspension systems-brakes -ABS -Steering system –Adaptive Cruise Control .Automotive sensors: introduction-working principle of sensors-throttle position sensors-manifold pressure sensor-mass air flow sensor-engine coolant temperature sensors-vehicle speed sensors-crankshaft position sensors-exhaust gas oxygen sensors

UNIT II
Fuel injection and Ignition system: Introduction -fuel system components-electronic fuel system-fuel injection-types-throttle body versus port injection-electronic control fuel injection-operation-different types-fuel injectors-idle speed control-continuous injection system-high pressure diesel fuel injection –multi point fuel injection system –Electronic ignition system-operation-types-Electronic spark timing control.

UNIT III
Safety and comfort : antilock braking system-traction control system-electric seats-mirrors and sun roofs-central locking and electric windows-cruise control-electric power steering-electronic clutch-electronic suspension system-airbags

UNIT IV
Electric vehicles and hybrid vehicles: Introduction-Electric Vehicle development-system layout-basic system components-fuel cell Electric vehicle. Hybrid vehicle: series Hybrid Vehicle -parallel Hybrid Vehicle-CNG Electric hybrid vehicle.

UNIT V
Vehicle Intelligence: Introduction -basic structure-vision based autonomous road vehicles-architecture for dynamic vision system -features-applications. An application of mobile robot vision to a vehicle information system-object detection-collision warning and Avoidance system-low tire pressure warning system.

TEXT BOOK:
1. Tom Denton, Automobile electrical and electronic systems, BH Publication, Third edition. 2004

REFERENCE BOOKS:
1. Willium B. Ribbens, Understanding Automotive Electronics - Sixth edition Elsevier Science 2003
2. Ronald K.Jurgen, Sensors and Transducers - SAE 2003
3. Jack Erjavec, Robert Scharff, Automotive Technology - Delmar publications Inc 1992
4. Ronald K.Jurgen, Electric and Hybrid-electric vehicles - SAE 2002
5. Ichiro Masaki, Vision-based Vehicle Guidance - Springer Verlag, Newyork 1992
6. Jay Webster, Class Room Manual For Automotive Service And System - Delmer Publications Inc 1995
7. Ron Hodkinson, John Fenton, Light Weight Electric/Hybrid Vehicle Design - Read Educational and Professional Publications Ltd. 2001.

<div align="center">

19MTRP 306 Electronics Laboratory

19MTRP 307 Digital Electronics Laboratory

19MTRP 308 Mechanical and Thermal Engineering Laboratory

19MTRP 309 Manufacturing laboratory

19MTRT 310 Industrial Training

19MTRC 401 PNEUMATIC AND HYDRAULIC SYSTEMS
</div>

UNIT I FLUID POWER, PUMPS.
Fluid Power –Definition –Pascal's Law- Basic Properties Of Hydraulic Fluids- Mass , Weight, Density, Specific Weight, Specific Gravity, Viscosity, Bulk Modulus. Hydraulic Pumps- Classification -Pump Types- **Piston Pumps** –Axial Piston Pump-
Radial Piston Pumps- Graphical Symbols – Working Principles only. **Gear Pumps**- External Gear Pump- Internal Gear Pumps. Graphical Symbols – Working Principles only. V**ane Pump**- Unbalanced Vane Pump – Balanced Vane Pump- Graphical Symbols – Working Principles only.

UNIT II LINEAR ACTUATORS, ROTARY ACTUATORS.
Linear Actuators- Hydraulic Cylinders - Cylinder Types-Single Acting cylinder -Gravity Return cylinder–Spring Return cylinder - Telescopic Cylinder – Hydraulic Ram –Tandem Cylinder , Symbols and working principles only- **Rotary actuators**-motor types –gear motor-balanced vane motor-piston motor –two vane rotor actuator-rack AND pinion rotary actuator-motor torque – speed – power –efficiency –symbols –applications –specifications.

UNIT III CONTROL VALVE
Directional Control Valves:-Check Valve-Shuttle Valves-Two Way Directional Control Valves -Three Way Directional Control Valves -Four Way Directional Control Valves – Directional Control Valves Actuation types-Symbols- Working Principles- **Pressure Control Valve:** Pilot Operated, Pressure Relief Valve –Pressure Reducing Valve – Sequence Valve – Symbols- Working Principles **Flow Control Valve** –Type –Needle Valve –Pressure Compensated Flow Control Valve-Cushioned Cylinders –Flow Dividers – Balanced Spool Flow Divider- Rotary Flow Divider .

UNIT IV HYDRAULIC COMPONENTS, MEASUREMENT, CONDUITS AND FITTINGS, HYDRAULIC CIRCUITS:
Hydraulic Components –Accumulators – types –Diaphragm - Spring Loaded -Weight Loaded -Pressure Intensifiers – Hydraulic Reservoirs-Heat Exchanger types- Air cooled – Water cooled - Filters. **Measurement**: Pressure Gauges-Flow meters- Temperature Gauges **Conduits and Fittings**-Pipe - Tubing –Hose - Seals and Bearings – Hydraulic Fluids. **Hydraulic Circuits:-**Counter Balance Circuit –Sequence Circuit- Speed Control Circuit-Meter in Circuit –Meter Out Circuit- Intermittent Feed Control-Speed Control For Continuous Processing – **Booster and Intensifier Circuits**-Force Multiplication – Pressure Intensification.

UNIT V PNEUMATICS SYSTEM, ELECTRONIC CONTROL FOR FLUID POWER PNEUMATICS
Basic principles of pneumatics-difference between hydraulics and pneumatics-compressor types-two stage piston compressor –rotary vane compressor-rotary screw compressor – vacuum pumps- double acting pneumatic cylinder–gear motor pressure regulator –filters-lubricators-FRL unit-water removal – air preparation and distribution – **Electronic control of fluid power** - solenoid valves-servo valves pump controls.

Text Books:
1. Industrial Hydraulics –Third Edition John J.PippengerTyler,G.Hicks.Mc.Graw-Hill Book Companys.
2. Introduction To Fluid Power--James L. Johnson.-Delmar Thomson Learning Inc.

Reference Books :
1. Fluid Power Technology-Robert P. Kokernale-Library Of Congress Cataloging-Publication Data.
2. Basic Fluid Power - Dudleyt, A Pease and John J Pippenger - Prentice Hall 1987.
3. Fluid Power With Applications - Antony Espossito, Prentice Hall 1980.
4. Hydraulics And Pneumatics - (HB) Adrewparr –Jaico Publishing House.
5. Pneumatic And Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987

<p align="center">**19MTRC 402 MEASUREMENT SYSTEMS AND SENSORS**</p>

UNIT I INTRODUCTION TO MEASUREMENT
Standards of measurement, Modes of measurement, generalized measurement system, Applications of Measurement System, Errors in measurement, sources of errors. Introduction, Sensors and Transducers – definition, difference between sensors and transducers, classification – Active and Passive sensors. Classification of Transducer: Basic requirements: Sensitivity, Specifications, Advantages and Disadvantages,

UNIT II MEASUREMENT OF DISPLACEMENT, VELOCITY AND ACCELERATION
Displacement measurement: Potentiometer sensor, LVDT, Position measurement: Optical encoder, Hall Effect sensor, Proximity measurement: Eddy current, Inductive, Velocity measurement: Electromagnetic, Tacho generators, Acceleration measurement: Piezoelectric accelerometer, strain gauge accelerometer**,** Force measurement: Hydraulic Load cell, spring balance, strain gauge, load cell. RVDT, Synchros and Resolvers

UNIT III MEASUREMENT OF PRESSURE, LEVEL, TEMPERATURE AND LIGHT
Fluid transducers: Pressure measurement: bourdon tube, tactile sensor, Flow measurement: orifice meter, venturi meter, Level measurement: float gauge, capacitance level sensor, Temperature Sensors: Temperature measurement: RTD's, Bimetallic strip, Light measurement: Working principles of photoelectric and photoconductive transducer, photo voltaic cell.

UNIT IV DIGITAL INSTRUMENTS, DISPLAYS AND RECORDERS:

Digital Instruments – Digital Vs Analog Instruments – Auto ranging – Auto zeroing – Auto Polarity – Block diagram of Digital Multimeter, Digital frequency counter, Digital Tachometer. **Displays** –Seven Segment Display, Alpha Numeric display, Liquid Vapour display (LVD). **Recorders** – Strip-chart recorder, X-Y recorder, CD recording and reproduction.

UNIT V DATA ACQUISITION SYSTEMS

Introduction, generalized DAS, objectives, configurations, analog and automated DAS, Single channel, multichannel DAS, applications, ADC: successive approximation, DAC: Weighted Resistor

TEXT BOOKS

1. Arun K Ghosh "Introduction to Measurements and Instrumentation " PHI 3rd Edition, 2009.
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000

REFERENCE BOOKS

1. Ernest O Doeblin "Measurement Systems Application and Design" Tata McGraw Hill Edition, 2004.
2. Sabrie Solomon, "Sensors and control systems in manufacturing", McGraw Hill international Editions, 1994.
3. Singh S.K., "Industrial Instrumentation and Control", Tata McGraw Hill Edition, 2003.
4. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.
5. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

19MTRC 403 METROLOGY AND MEASUREMENTS

UNIT I

Mechanical measurement- direct comparison and indirect comparison-the generalized measurement system- types of input quantities- calibration- uncertainty- systematic and random errors-common - type of errors- classification of errors-terms used in rating instrument performance- introduction to uncertainty analysis-propagation of uncertainty- Kline and Mclintock approach .

UNIT II

Methods of measurement- significance, generalized measuring system. Introduction – Metrology – Inspection – Definition of terms-Accuracy – Precision – Tolerance – Surface finish – Quality – Reliability – Interchangeability. **Form Measurement:** Dial indicators, Measurement of major diameter, minor diameter, flank angle, pitch and effective diameter of screw thread.

UNIT III

Linear Measurement: Vernier calliper, Gear tooth vernier, plunger dials, Slip gauges, Inside/ Outside Micrometer. **Angular Measurement:** Sine Bar, Bevel protractor.

UNIT IV

Surface finish Measurement: Surface Roughness, Symbols, Roughness comparison as per specimen, Ra, Rz, Rq, Rt, Rp, Rv - Principle and operation of stylus probe instruments. Inspection using gauges: Types- limit gauges, Indicative snap gauge, Plain plug gauge, ring gauges, Radius gauges, and Feeler gauges - Gauge design.

UNIT V

Measuring Machines: Auto collimator, Comparator - Mechanical comparator, Electronic comparator, Optical comparators, Pneumatic Air gauge, Electronic Air gauge, laser interferometer, roundness tester, Co-ordinating measuring machine (CMM), Surface Roughness tester (Stylus and Skid).

TEXT BOOKS

1. Anand K Bewoor and Vinay A Kulkarni "Metrology and Measurement" Tata McGraw Hill Edition, 2009.
2. A.K.Sawhney "A course in electrical and electronic measurements and instrumentation" Dhanpat rai and co (p) ltd seventeenth edition, 2002.

REFERENCE BOOKS

1. Ernest O Doeblin "Measurement Systems Application and Design" Tata McGraw Hill Edition, 2004.
2. Thomas G. Beckwith, Roy D. Marangoni , John H. Lienhard V "Mechanical Measurements" Prentice Hall, 6th Edition, 2007.
3. Sabrie Solomon, "Sensors and control systems in manufacturing", McGraw Hill international Editions, 1994.
4. Galyer.J.F.W. Shotbolt, C.R., "Metrology for Engineers", ELBS with Casell Ltd., UK, Fifth Edition, 1990.
5. Jain, R.K, "Engineering Metrology", Khanna publishers, 2009.
6. R.K.Rajput, "Engineering Metrology and Instrumentation", Kataris& sons Publishers, 2001.
7. Singh S.K., "Industrial Instrumentation and Control", Tata McGraw Hill Edition, 2003.

19MTRC 404EMBEDDED SYSTEMS

UNIT I

Basic Concepts: Microprocessor and Microcontroller, Von Neumman and Harward, Intel 8085 microprocessor architecture (only) Introduction to Embedded systems: Design Metrics, Examples of embedded systems, hardware/software co-design, Embedded micro controller cores (ARM, RISC, CISC, and SOC), Embedded memories, Architecture of Embedded Systems

UNIT II 8051 MICROCONTROLLER

Architecture**:** Features, architecture and pin configurations, CPU timing and machine cycle, Input / Output ports, Memory organization, Counters and timers, Interrupts, Serial data input and output

8051 Assembly Language Programming: Instruction set, Addressing mode, Assembler directives and programs

8051 Interfacing: LED, LCD, seven segment display, keyboard, ADC, DAC, Stepper Motor, Relay and Serial Communication

UNIT III ARM7: A 32-BIT MICROCONTROLLER

Architecture**:** Features of ARM Microcontroller, Operating modes, Architecture, Registers, CPSR, Pipeline, Exceptions, interrupt vector table, memory management, ARM7 processor families

ARM7 Programming: Instruction set, Addressing mode and programs

UNIT IV EMBEDDED SOFTWARE DEVELOPMENT

Assemblers, linkers and loaders. Binary file formats for processor executable files. Typical structure of timer-interrupt driven programs. GNU-GCC compiler introduction, programming with Linux environment and gnu debugging, gnu insight with step level trace debugging, make file interaction, building and execution.

Embedded C-programming concepts: Optimizing for Speed/Memory needs, Interrupt service routines, macros, functions, modifiers, data types, device drivers

UNIT V REAL TIME OPERATING SYSTEM

Real Time Operating System Concepts, Kernel Structure, Critical Sections, Multitasking, Task Management, Time Management, Schedulers, Event Control Blocks, Priorities, Deadlocks, Synchronization, Semaphore Management, Mutual Exclusion, Message Mailbox Management, Message Queue Management, Memory Management, RTOS implementation. Example of OSs for embedded systems - RT Linux.

TEXT BOOKS

1. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, Second Edition 2006.
2. Rajkamal, Embedded Systems - Architecture, Programming and Design, Tata McGraw Hill, Second edition, 2009

REFERENCE BOOKS

1. Microprocessor architecture and applications with 8085: By Ramesh Gaonkar (Penram International Publication).
2. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010.
3. Andrew Sloss, Dominic Symes, and Chris Wright, "ARM System Developer's Guide" Morgan Kaufmann Publishers, First Edition 2004.
4. James A. Langbridge, "Professional Embedded Arm Development", Wrox, John Wiley Brand& Sons Inc., Edition 2014
5. Frank Vahid and tony Gavages "Embedded system design – A unified hardware / software introduction", Wiley publication, Third edition 2002.
6. Embedded/Real-Time Systems: Concepts, Design & Programming – Dr. K. V. K. K. Prasad, Dreamtech Press, India.

19MTRC405 INDUSTRIAL ELECTRONICS

UNIT I MOTOR CONTROL DEVICES AND CIRCUITS

Pilot Devices: Manually operated switches: Toggle switch, Slide switch, DIP switch, Rotary switch, Push button switch, Drum switch. Mechanically operated switches: Limit switch, Micro switch, Temperature switch, Pressure switch, Float switch, Flow switch. Manual control devices: Disconnect switch, Manual motor starter Contactors and motor starters: Contactors, Magnetic motor starter, and Solid state contactor.

UNIT II MAGNETS, SOLENOIDS, RELAYS, TIMER AND COUNTERS

Introduction, electromagnets, Solenoid: Basic solenoid action, Inline (or ON/OFF) solenoid valve, Solenoid valves: 3-way 2 position, Applications of solenoids. Relays: Electro mechanical control relays, Solid state relays, Timing relays, Latching relays, Relay logic. Timers: Introduction, Pneumatic timer, Electromechanical motor driven timer, Solid state Electronic timer, Application of timers, Counters: Mechanical counter, Electro mechanical counter, Solid state counters, Programmable timer/counter. Sequencers: Introduction, Programmable sequencers.

UNIT III CONTROL THE SPEED OF MOTORS FOR DIFFERENT APPLICATIONS

Stepper motor: Construction, Operation of stepper motor, Control of stepper motors, Application of stepper motors - Print wheel control system – Disc head control system - Robot arm. Servo Motors: AC servo motor, Construction, operation, Torque speed

characteristics. Servo amplifiers, Applications. DC servo motors: Construction, operation, Characteristics, Amplifiers. Brushless DC motors. Speed control of small motor, DC drive system, Variable frequency AC drive system.

UNIT IV MOTOR CONTROL CIRCUITS

Control circuits and load circuits: Two wire control circuit, Three wire control circuit, Three wire start/stop circuit with multiple start/stop push button, Three wire control circuit with indicator lamp, Reverse motor starter, Jogging

UNIT V POWER DISTRIBUTION SYSTEM AND INDUSTRIAL ELECTRICAL DIAGRAMS

Introduction, Stages in power delivery system, Emergency power supply system: On site alternator, UPS system, Inplant distribution. Power sources: Batteries, Switch mode power supply. Electrical symbols, Diagrams, Wiring diagram, Schematic diagram, Block diagram, Single line diagram, Ladder diagram.

TEXT BOOKS

1. E.Kisseli, "Industrial Electronics", PHI Publications
2. E. Kisseli, " Modern Industrial/Electrical Motor Controls", PHI Publications

REFERENCE BOOKS

1. E.Kisseli, "Motor Control Technology for Industrial Maintenance", PHI Publication
2. Stephen L Herman, " Industrial Motor Control", Delmar Cengage Learning
3. B.L.Theraja, " ABC Electrical Engineering", S.Chand Co., New Delhi

19MTRC 501 COMPUTER AIDED DESIGN AND MANUFACTURING

UNIT I
INTRODUCTION TO CIM AND COMPUTER AIDED DESIGN &ANALYSIS
CIM: Introduction of CIM – concept of CIM - evolution of CIM – CIM wheel– Benefits – integrated CAD/CAM.**CAD:** Computer Aided Design **–** Introduction – CAD definition – Shigley'sdesign process – CAD activities – benefits of CAD. Types of CAD system –Host and terminal based CAD system - PC based CAD system –workstation based CAD system – graphics workstation – CAD softwarepackages. 2D&3D transformations – translation, scaling, rotation andconcatenation.Geometric modeling: Techniques: Wire frame modeling – surface modeling– solid modeling: Boundary representation – Constructive Solid Geometry– Comparison.Graphics standard – Definition –Need - GKS – IGES – PHIGS – DXF.Cost involved in design changes – Concept of Design for Excellence (DFX)– Guide lines of Design for Manufacture and assembly (DFMA).

UNIT II
COMPUTER AIDED MANUFACTURING AND RAPID PROTOTYPING
CAM: Definition – functions of CAM – benefits of CAM – Group technology– Part families - Parts classification and coding - coding structure – Optizsystem, MICLASS system and CODE System - process planning – CAPP– Types of **CAPP :** Variant type, Generative type – advantages of CAPP -production planning and control – computer integrated productionmanagement system – Master Production Schedule (MPS) – Capacityplanning – Materials Requirement Planning (MRP) –ManufacturingResources Planning (MRP-II)– Shop floor control system - Just in timemanufacturing philosophy- Introduction to enterprises resources planning.Product Development Cycle – Sequential engineering – Concurrentengineering.Rapid proto typing: concept and applications – materials – types – Stereolithography – laser sintering – Deposition Modeling - 3D printing.

UNIT III
CNC MACHINE AND COMPONENTS
CNC Machines: Numerical control – definition – components of NCsystems – development of NC – DNC – Adaptive control systems –working principle of a CNC system – Features of CNC machines -advantage of CNC machines – difference between NC and CNC –Construction and working principle of turning centre – Construction and working principle of machining centers – machine axes conventions turningcentre and machining centre – design considerations of NC machine tools. CNC EDM machine – Working principle of die sinking and wire EDMmachines - Coordinate Measuring Machines: construction and workingprinciples.
Components of CNC machine.
Drives: spindle drive – dc motor – Feed drives – dc servo motor andstepper motor – hydraulic systems – Slide ways – requirement – types –friction slide ways and anti friction slide ways - linear motion bearings –recirculation ball screw – ATC – tool magazine – feedback devices – linearand rotary transducers – Encoders - in process probing.

UNIT IV
PART PROGRAMMING: NC part programming – methods – manualprogramming – conversational programming – APT programming - Format:sequential and word address formats - sequence number – coordinatesystem – types of motion control: point-to-point, paraxial and contouring –Datum points: machine zero, work zero, tool zero NC dimensioning –reference points – tool material – tool inserts - tool offsets andcompensation - NC dimensioning – preparatory functions and G

codes,miscellaneous functions and M codes –interpolation: linear interpolationand circular interpolation - CNC program procedure.

Part Program – macro – sub-program – canned cycles: stock – mirrorimages – thread cutting – Sample programs for lathe : Linear and circularinterpolation - Stock removal turning – Peck drilling – Thread cutting andSample programs for milling: Linear and circular interpolation – mirroring –sub program – drilling cycle – pocketing – Generating CNC codes fromCAD models – post processing

UNIT V

FMS, AGV AND INTEGRATED MATERIAL HANDLING

Types of manufacturing - introduction to FMS – FMS components – FMSlayouts – Types of FMS: flexible manufacturing cell – flexible turning cell –flexible transfer line – flexible machining systems – benefits of FMS -introduction to intelligent manufacturing system – virtual machining.Computer Integrated material handling – AGV: working principle – types -benefits – Automatic Storage and Retrieval Systems (ASRS).

TEXT BOOKS

1. CAD/CAM/CIM , R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
2. CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.
3. CNC Programming, S.K.Sinha, Galgotia Publications Pvt. Ltd.

REFERENCE BOOKS

1. CAD/CAM Principles and Applications, Dr.P.N.Rao, Tata Mc Graw Hill publishing Company Ltd.
2. CAD/CAM, Ibrahim Zeid, Mastering Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education Asia.
4. Computer control of manufacturing systems,Yoram Koren, McGraw Hill Book.

19MTRC502 INDUSTRIAL AUTOMATION

UNIT I

PLC Basics: Parts of a PLC -Principles of Operation –Advantages and Disadvantages of PLC - PLC Size and Application- The I/O Section -Discrete I/O Modules-Analog I/O Modules-Special I/O Modules – I/O Specifications-Scanning cycle of PLC-The CPUMemory Design-Memory Types

UNIT II

Programming PLC: Processor Memory Organization- PLC Programming Languages- PLC Modes of Operation- Relay-Type Instructions- Instruction Addressing-Branch Instructions Internal Relay Instructions Programming EXAMINE IF CLOSED and EXAMINE IF OPEN Instructions- Designing a Ladder Diagram for large process – Programming TimersProgramming counters-programming Analog module -HMI programming-Interfacing PLC with HMI

UNIT III

DCS and SCADA: Basic concepts of Distributed Computing-Evolution of Distributed Computing System-Present market trends in DCS-Basic DCS specification-General description of commercial DCS -Advantage of DCS systems -DCS selection criteria - DCS architecture. Basics of SCADA system-SCADA key features - Remote terminal units (RTUs)-Typical requirements for an RTU system - PLCs used as RTUs-Consideration and benefits of SCADA system- DCS versus SCADA terminology-SCADA software package.

UNIT IV

Fluidic Drives in Automation: Fundamentals of hydraulic and pneumatic drives-basic definitions and principles-benefits of fluidic drives-components of fluidic drive systemsControl valves Classification-Pressure, Directional, Proportional and servo valves-Basic Fluidic circuits.

UNIT V

Electric Drives in automation: Induction motor drive: V/F Control, Direct torque control, VFD Configuration & Programming, Stepper motor drive, objectives of servo control, Elements of servo control, Structure of servo control Industrial Networks: Profibus, Field bus, Sercos, Ethernet, Application of Wireless Networks for Industrial automation – Basics of Industry4.0

TEXT BOOKS

1. Frank D petruzella, "Programmable logic controllers", Fourth edition,McGraw Hill higher education ,2016
2. 2. Rajesh Mehra (Author), Vikrant Vij (Author),"PLCs & SCADA: Theory and Practice", Laxmi Publications-2016
3. 3. Steve Mackay ,Edwin Wright MIPENZ, Deon Reynders, John Park "Practical Industrial Data Networks -Design, Installation, trouble shooting" ,IDC Technologies, Australia.
4. Frank D petruzella, "Electrical Motor and control systems", McGraw Hill higher education ,2010

REFERENCE BOOKS

1. Krishna Kant –"Computer Based Industrial Control", EEE-PHI, 2nd edition, 2010.
2. Garry Dunning-Introduction to Programmable Logic Controllers, 2nd edition, Thomson, ISBN: 981-240-625-5.

<div align="center">

19MTRC 503 MECHATRONICS SYSTEM DESIGN

</div>

UNIT I Introduction to Mechatronic System Design:
Key elements – Mechatronics Design process –Design Parameters – Traditional andMechatronics designs – Advanced approaches in Mechatronics - Industrial design andergonomics, safety.
UNIT II System Modelling by Bond Graphs:

Introduction-model categories-fields of application, generalized variables in bond graph-Powervariables – Energy variables, Basic components in Bond graph-1 Port components- 1 PortResistor- 1 Port Capacitor – 1 Port Inductor, 2 Port components-Transformer- Gyrator, 3 PortComponents – 0 Junction, 1 Junction, Model development-Design examples.

UNIT III Generalized Mechatronics Design Process:
Recognition of the Need, Conceptual Design and Functional Specification, First principle Modular Mathematical Modeling, Sensor and Actuator Selection, Drivers for Actuators, ControlSystem Design, Design Optimization, Prototyping, Hardware-in-the-loop Simulation,Deployment/Life Cycle, Deployment of Embedded Software, Life Cycle Optimization.

UNIT IV Case Study: Design of Mobile Robot -Introduction, , Design Specifications (Drive MotorSizing, Steering Motor Sizing, Gear System, Kinematic Analysis, Mechanical Constructions),Mechanical Design Alternatives, Electronic Circuits (Drivers) and Interfacing (Sensors, SerialCommunication Circuit, Robot Circuitry, Motor Driving Circuitry, Communication Strategy),
Software Development (Serial Communication Algorithm, Motion Algorithm, Map Generation).

UNIT V Design of cantilever beam vibration control system based on piezo sensors andactuators - Introduction, Modeling of the Cantilever Beam and PZT Actuator (Modeling of theBeam, Modeling of the PZT Actuator, Modeling of the Sensor), Beam Experimental Setup(properties and dimensions of the beam, dimensions and bonding techniques), instrumentalsetup (Charge amplifier, Voltage amplifier, Data Acquisition), Controller and Software(Development of the PID VI)

TEXT BOOKS

1. Shruva Das, "**Mechatronic Modelling and Simulation Using Bond Graphs**" CRC Press,2009.
2. W. Bolton, "**Mechatronics – Electronic control systems in Mechanical & ElectricalEngineering**", Pearson Education Ltd., 2003.
3. Shetty and Kolk , "**Mechatronics System Design**" , CENGAGE Learning, India, secondedition, 2011.

REFERENCE BOOKS
1. Bishop, Robert H, "**Mechatronics Hand book**", CRC Press, 2002.
2. Kenji Uchino and Jayne R. Giniewicz, "**Mechatronics**" publication: Marcel Dekker, Inc.
3. Smaili and F. Mrad, "**Applied Mechatronics**", OXFORD university publication April 2008.

<div align="center">

LIST OF ELECTIVES

1. AUTOMATIVE MECHATRONICS

</div>

UNIT I

Introduction to Automotive Mechatronics Introduction, Need, Automotive Mechatronicsapproach, Components-Electrical, Mechanical, Electronics systems, Software, Interfacing. Examples.

UNIT II

Automotive Systems I Transmission Control – Automatic transmission – Mechanism – ControlModes - control algorithm – sensors - Mechatronic gear shift – Power train, Braking Control–Tire Road Interface – Vehicle dynamics during Braking - Control components – Anti lockBraking System – Sensotronic Braking System, Steering Control– Drive by Wire – Sensors –Actuators – Communication – Four wheel Steering Systems.

UNIT III

Automotive Systems II Cruise Control – Cruise Control Design - Adaptive Cruise Control –Control Software – Fail Safe, Traction Control - Optimizing Traction – Forces affecting wheeltraction - Components– Automatic traction control - Traction control in cornering – ControlAlgorithm, Suspension Control - System Configuration – suspension control dynamics – Hydropneumatic suspension control system.

UNIT IV

Automotive systems III Stability Control – Vehicle Dynamics Controller – Sensors – Interface -VDC Safety Concept - Electronic Stability programme (ESP), Engine Control – Electricallysupported turbo charger - electromagnetic engine valve

UNIT V

Automotive Systems IV Airbags, Tire pressure monitoring systems, Automatic head lightcontrol, Folding roof, Wiper Control, Electronic Cabin control

TEXT BOOKS

1. Uwe Kiencke, Lars Nielsen, "**Automotive Control Systems**", by Springer second edition, 2005.
2. Ronald K Jurgen, "**Automotive Electronics**", by McGraw Hill, second edition. (Originaledition- 1999).

REFERENCE BOOKS

1. Robert K Bishop," **Mechatronics Handbook**", CRC Press, 2002.
2. Rolf Isermann ,"Mechatronics Systems: Fundamentals", Springer 2005.
3. Bosch Professional Automotive Information, "**Automotive Mechatronics: AutomotiveNetworking, Driving Stability Systems, Electronics**" published by Springer in 2014.

2 INDUSTRY INTERNET OF THINGS

UNIT I
Introduction to the industrial Internet
Horizontal and vertical aspects of IOT – Definition of Industrial Internet – Power of I% - need for industrial internet – Catalysts and precursors of the IOT – opportunity and benefits –applications of industrial internet – health care, oil and Gas industry, smart office, logistics,retail.
UNIT II
Technical innovations of industrial internet
Minimization – cyber physical systems(CPS) – wireless technology – IP mobility –network functionality virtualization (WFV) – Network virtualization – software defined

network(SDN) – smart phones – The cloud and fog – Big data and analytics – M2M learning andartificial intelligence – augmented reality – 3Dprinting.

UNIT III
IIOT Architecture

M2M and IIOT architecture – IIC Reference Architecture – Industrial Internet architectureframework – functional, control, operational, information, application, business domain –architecture topology – three tier topology – gateway mediated edge – connectivity – keysystem characteristics, functional characteristics, function of communication layer – Datamanagement – Query, Storage, persistence, Retrieval, Advanced data analytics.

UNIT IV
Designing Industrial internet systems.

Designing low power device network – industrial protocols – modern communicationprotocols – wireless communication technologies – proximity network communication protocols– middle wave transport protocols – middle wave software patterns – software design concept – middle wave industrial internet of things platform – IIOT WAN technology and protocols –securing the industrial internet,Case study-Electric vehicle Charging

UNIT V
Introduction to industry 4.0

Defining industry 4.0 – need – characteristics of industry 4.0 – value chain – benefits of –Design principles building blocks of industry 4.0 – reference architecture – smart factories –smart gird – industry 4.0 business models.

TEXT BOOKS

1. Alasdair Gilchrist **"Industry 4.0 industrial internet** ", Aprcas publications 2016
2. Oliviver Hersent, David Boswarthink Omar Elloumi **"The internet of things"** – WILEYPublications 2012.

REFERENCE BOOKS

1. Dieter Uckelmann,MarkHarrison, FlorianMichahelles, "**Architecting the Internet ofThings**",Springer,2011
2. Donald Norris, "**The Internet of Things: Do-It-Yourself at Home Projects for Arduino,Raspberry Pi and BeagleBone Black**",Mc.Graw Hill,2015.
3. CunoPfister, "**Getting Started with the Internet of Things**", O'Reilly Media, Inc.,2011

3 INDUSTRIAL COMMUNICATION NETWORK

UNIT I

Data Network Fundamentals

Data networks in Modern Instrumentation and automation systems -Components of ComputerNetworks: hardware and software -Network topologies: Star, Ring, Bus, Mesh –NetworkClassification Based on Transmission Technologies: Point-to-point, broadcast -Based on scale:LAN, WAN, MAN,VPN, Internet -Based on Architecture: Peer to Peer, Client Server,advantages of Client Sever over Peer-to-Peer Model -OSI Model

UNIT II

Network communication Media

Overview of RS-232,RS-485standards-Transmission Media: Unguided and Guided media,Wired and Wireless, UTP, Coaxial and Fiber optical cable -Types of Connectors: RJ-45, RJ-11,BNC, BNC –T, BNC Terminator, Fiber optic connectors:- Subscriber Channel(SC), StraightTip(ST), Mechanical transfer – registered jack(MT-RJ) connectors - Network Interface Card(NIC), ARCNET, Ethernet. Network connecting devices: Repeater, Hub, Bridge, Switch ,Router, Gateway, Access point, Wireless Access points.

UNIT III

TCP/IP , Field Bus and Profibus

TCP/IP:OSI model, Internet layer protocol, Host to Host layer Field Bus: Features, wiring rules,Data link layer, application layer, user layer Profibus : features- Profibus protocol stack-Profibuscommunication model-relationship between application process and communicationcommunicationobjects-system operation

UNIT IV

Modbus and Hart

Modbus: general overview, Modbus protocol structure, Function codes. Hart: Hart and smartinstrumentation, Hart protocol, physical layer, data link layer, application layer.

UNIT V

Industrial Ethernet and Wireless Networks

Industrial Ethernet: overview, 10 Mbps ,100 Mbps, Gigabit-design considerations ,recentdevelopments in industrial Ethernet. Wireless Networks: Topology, Standards, WLAN, WPAN,Industrial Automation requirements, Application of wireless network for industrial automation,Basics of Industry 4.0.

TEXT BOOKS

1. Deon Reynders, Steve Mackay, Edwin Wright "**Practical Industrial datacommunications**" ,ELSEVIER 2012.
2. John park and Steve Mackay "**Data acquisition for Instrumentation and controlsystems**" by, IDC Technologies 2003.

4   ROBOTICS

UNIT I
Basic Configuration of Robotics and its Working

Introduction – definition – basic configuration of robotics and itsworking –robot components – manipulator, end effectors, drive system,controller, sensors –mechanical arm – degrees of freedom – links andjoints – construction of links, types of joint – classification of robots –Cartesian, cylindrical, spherical, horizontal articulated (SCARA), verticalarticulated – structural characteristics of robots –work envelope and workvolume - robot work volumes and comparison – wrist rotations –mechanical transmission, pulleys, belts, gears, harmonic drive –conversion between linear and rotary motion and its devices.

UNIT II
Robot Controller and Servo Systems
Robot controller – level of controller – open loop and closed loop controller–servo systems — robot path control – point to point – continuous pathcontrol – sensor based path control – controller programming – actuators –dc servo motors – stepper motors – hydraulic and pneumatic drives -feedback devices – potentiometers – optical encoders – dc tachometers.

UNIT III
Robot Motion Analysis and Vision System
Robot motion analysis – robot kinematics – robot dynamics - end effectors–grippers and tools - gripper design – mechanical gripper – vacuumgripper –magnetic grippers – sensors – transducers – tactile sensors –proximity sensors and range sensors – force and moment sensors and itsapplications and problemsphotoelectric sensors – vision system – image processing and analysis –robotic applications – robot operation aids – teach pendent – MDI andcomputer control

UNIT IV
Robot Programming
Robot programming – lead through methods and textual robot languages –motion specification - motion interpolation - basic robot languages –generating of robot programming languages – On-Line & Off-Lineprogramming - robot language structure – basic commands – artificialintelligence and robotics.

UNIT V
Robot Application in Manufacturing
Robot application in manufacturing – material handling –assembly finishing–adopting robots to work station - requisite and non – requisite robotcharacteristics –stages in selecting robot for individual application –precaution for robot –future of robotics.Economics analysis for robotics – cost data required for the analysis –methods of economic analysis – pay back method – equivalent uniformannual cost method – return on investment method.

TEXT BOOKS
1. Mikkel P.Groover, Mite chell weiss, Rogern Negal and Nicholes G.Odress, Industrial Robotics Technology- Programming and Applications
2. R.K.Mittal, I.J.Nagrath, Robotics and controls, Tata Mcgraw Hill Education Pvt.Ltd.

REFERENCE BOOKS
1. Doughlaes –R. HAlcoojr, An Introduction to robotics.
2. Robotics – An Introduction – Doughales – R. Halconnjr. An Introduction to Robotics

5   BIOMECHATRONICS

UNIT I INTRODUCTION
Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION
Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive,fiber-optic, photoelectric and chemical transducers – their description and feature applicable forbiomedical instrumentation – Bio & Nano sensors & application

UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY
Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Ampelectrometeramplifier, carrier Amplifier – instrument power supply. Oscillagraphic – galvanometric -X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems –Telemetry principles – Bio telemetry.

UNIT IV MEDICAL SUPPORT
Electrocardiograph measurements – blood pressure measurement: by ultrasonic method –plethysonography – blood flow measurement by electromagnetic flow meter cardiac outputmeasurement by dilution method – phonocardiography – vector cardiography. Heart lung machine –artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner –Bio-telemetry – laser equipment and application – cardiac pacemaker – DC– defibrillator patientsafety - electrical shock hazards. Centralized patent monitoring system.

UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION
Introduction – computers in medicine – basis of signal conversion and digital filtering data reductiontechnique – time and frequency domain technique – ECG Analysis.

TEXT BOOKS
1. Siamak Najarian " Mechatronics in Medicine – A Bio medical engg approach" , McGraw – Hill Education , 2011
2. Cromwell, Weibell and Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, Printice Hall of india , 1999
3. Arumugam M., "Bio Medical Instrumentation", Anuradha agencies Pub., 2002

REFERENCE BOOKS
1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, 1989.
2. Geddes L.A., and Baker, L.E., "Principles of Applied Bio-medical Instrumentation", 3rd Edition, John Wiley and Sons, 1995.
3. Tompkins W.J., "Biomedical Digital Signal Processing", Prentice Hall of India, 1998

6   AUTOMOBILE ENGINEERING

UNIT I VEHICLE STRUCTURE AND ENGINES
Types of automobiles, vehicle construction and different layouts, chassis, frame andbody, Vehicle aerodynamics (various resistances and moments involved), IC engines –componentsfunctionsand materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS

Electronically controlled gasoline injection system for SI engines, Electronicallycontrolled diesel injection system (Unit injector system, Rotary distributor type andcommon rail direct injection system), Electronic ignition system (Transistorized coil ignition system,capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engineemission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS

Clutch-types and construction, gear boxes- manual and automatic, gear shiftmechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints,universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle,Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, AntilockBraking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol andHydrogen in Automobiles- Engine modifications required –Performance ,Combustionand Emission Characteristics of SI and CI engines with these alternate fuels – Electricand Hybrid Vehicles, Fuel CellNote: Practical Training in dismantling and assembling of Engine parts and Transmission Systemsshould be given to the students.

TEXT BOOKS:
1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Standard Publishers, Seventh Edition, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:
1. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.
4. Heinz Heisler , "Advanced Engine Technology," SAE International Publications