ORDINANCE

FOR

B.TECH. ROBOTICS AND AUTOMATION ENGINEERING

GNA UNIVERSITY

Inspiring Innovation.....

(THIS ORDINANCE HAS BEEN APPROVED IN THE MEETING OF
BOARD OF STUDIES HELD ON DATED 27 May, 2022)

APPLICABLE W.E.F. ACADEMIC SESSION 2022-2023

GNA UNIVERSITY
SRI HARGOBINDGARH, PHAGWARA – HOSHIARPUR ROAD,
PHAGWARA 144401, PUNJAB

SRI HARGOBINDGARH, PHAGWARA – HOSHIARPUR
ROAD,PHAGWARA 144401, PUNJAB

ORDINANCE FOR B.TECH. ROBOTICS AND AUTOMATION ENGINEERING

SHORT TITLE AND COMMENCEMENT

I. This Ordinance shall be called the Ordinance for the B.Tech. Robotics and Automation Engineering of GNA University, Phagwara.

II. This ordinance shall come into force with effect from academic session 2022-23.

1. Name of Program: B.Tech. Robotics and Automation Engineering

2. Name of Faculty: Faculty of Engineering, Design and Automation.

3. Program Outcomes:

I) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering, specialization to the solution of complex engineering problems.

II) **Problem analysis:** Identify, formulate, research literature, and analyze engineeringproblems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

III) **Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

IV) **Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

V) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

VI) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

VII) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

VIII)Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

XI) **Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

X) **Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

XI) **Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

XII) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

comprise of two semesters. In addition, each semester shall normally have 90 working days.

4. Program Specific Outcomes:

After the completion of B.Tech. Robotics and Automation Engineering, the student will be able to:

I. Apply the knowledge to plan the trajectory for various robotic manipulators by using different techniques.

II. Understand and adapt to the different robotic control environments, robotic vision and various sensing techniques.

III. Apply the skills to solve complex multi-disciplinary problems, identify the type of robotic manipulator required and to provide a Robotic solution to serve the purpose.

IV. Practice and implement new ideas for the product design and development and to provide the adequate design and manufacturing solution through the updated CAD/CAM technologies.

5. Program Duration: Total duration of the Program shall be of 4 years and each year will comprise of two semesters. In addition, each semester shall normally have 90 working days.

6. Eligibility for Admission: 10+2 or equivalent (with Physics, Chemistry and Mathematics as compulsory subjects) with 50% (45 % for SC/ST/OBC) marks in aggregate from any recognized board.

7.Admission Process: The centralized admission cell shall make selection for admission to the program. The selection of the candidate shall be strictly on merit basis, subject to fulfillment of eligibility criteria. Candidates are required to fill the prescribed application form and submit the same to the admission cell. The admission cell after verifying the eligibility will forward the form to the Office of Registrar for further processing. If the candidate is selected, he/she is required to deposit the prescribed fee along with the application form and the required documents to the Office of Registrar.

8. Curriculum: The 4 years curriculum has been divided into 8 semesters and shall include lectures/tutorials/laboratory work/field work/outreach activity/project work/vocational training/viva/seminars/presentations/term papers/assignments etc. or a combination of some of these. The curriculum will also include other curricular, co-curricular and extra curricular activities as may be prescribed by the University from time to time.

9. Choice Based Credit System:

The University has adopted Choice Based Credit System (CBCS), which provides an opportunity to the students to choose courses from the offered courses comprising of Core, Elective, Ability Enhancement and Audit Courses. The choice-based credit system provides a "flexible" approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Following are the types of courses and structure for the program:

Course Categories:

I. BSC:	Basic Science Courses
II. ESC:	Engineering Science Courses
III. HSMC:	Humanities and Social Sciences including Management courses
IV. PCC:	Professional core courses
V. PEC:	Professional Elective courses
VI. OEC:	Open Elective courses
VII. LC:	Laboratory course

VIII. MC: Mandatory courses (Audit Course)

IX. PROJ: Project

Audit Course

The introduction of two Audit courses covering subjects of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value education, Disaster management, Sanskrit, Pedagogy, Constitution of India, Personality development through Indian culture etc.

10. Medium of Instructions:

10.1 The medium of instructions and examination will be English.

10.2 Practical work/Project Work / Project Report / Dissertation / Field Work Report / Training Report etc., if any, should be presented in English.

11. Mode: The program is offered in 'Full Time' mode of study only.

12. Attendance Requirement to be Eligible to Appear in End Semester Examination:

12.1 Every student is required to attend at least 75% of the lectures delivered squaring tutorials, practical and other prescribed curricular and co-curricular activities.

12.2 Dean of Faculty may give a further relaxation of attendance up to 5% to a student provided that he/she has been absent with prior permission of the Dean of the Faculty for the reasons acceptable to him/her.

12.3 Further, relaxation upto10% may be given by The Vice Chancellor to make a student eligible under special circumstances only.

12.4 No student will be allowed to appear in the end semester examination if he/she does not satisfy the attendance requirements. Further, the attendance shall be counted from the date of admission in the University or commencement of academic session whichever is later.

13.Credit: Each course, except a few special audit courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and/or laboratory contact hours in a week. A letter grade, corresponding to specified number of grade points, is awarded in each course for which a student is registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average. A minimum number of credits should be acquired to qualify for the programs. The absolute grading system has been followed for awarding grades in a course.

Earned Credits (EC): The credits assigned to a course in which a student has obtained 'D' (minimum passing grade) or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained F, or W or "I" grade will not be counted towards his/her earned credits. A unit by which the course is measured. It determines the number of hours of instruction required per week.

Contact Hours per Week	Credit Assigned
1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
2 Hours Practical (Lab) per week	1 credit

14. Program Structure:

Semester I (First Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	BSC	BTC101	Engineering Chemistry	3	1	0	40	60	100	4
2.	BSC	BEM101	Engineering Mathematics-I	3	1	0	40	60	100	4
3.	ESC	BCS302	Object Oriented Programming using C++	3	0	0	40	60	100	3
4.	ESC	BME101	Engineering Drawing& Graphics – 2D	1	0	4	40	60	100	3
5.	HSMC	COM101	English Communication	2	0	0	40	60	100	2
6.	LC	BME121	Workshop Practice	0	0	4	60	40	100	2
7.	LC	BTC121	Engineering Chemistry Laboratory	0	0	2	30	20	50	1
8.	LC	BCS322	Object Oriented Programming using C++ Laboratory	0	0	2	30	20	50	1
9.	LC	COM121	English Communication Lab	0	0	2	30	20	50	1
10.	MC	ENS001	Environmental Studies	2	0	0	40	0	40	S/US (Non-Credit)
Total							**390**	**400**	**790**	**21**

Semester II (First Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	BSC	BTP101	Engineering Physics	3	1	0	40	60	100	4
2.	BSC	BEM201	Engineering Mathematics– II	3	1	0	40	60	100	4
3.	ESC	BEE101	Basic Electrical and Electronics Engineering	3	1	0	40	60	100	4
4.	ESC	BME201	Engineering Drawing & Graphics – 2D	1	0	4	40	60	100	3
5.	HSMC	COM201	Business Communication	2	0	0	40	60	100	2
6.	LC	BME122	Manufacturing Practices	0	0	4	60	40	100	2
7.	LC	BTP121	Engineering Physics Laboratory	0	0	2	30	20	50	1
8.	LC	BEE121	Basic Electrical and Electronics Engineering Laboratory	0	0	2	30	20	50	1
9.	LC	C0M221	Business Communication Lab	0	0	2	30	20	50	1
10.	MC	BMC001	Constitution of India	2	0	0	40	0	40	S/US (Non-Credit)
Total							**390**	**400**	**790**	**22**

Semester III (Second Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	BSC	BEM301	Engineering Mathematics - III	4	1	0	40	60	100	5
2.	ESC	BCS209	Basics of Python	3	0	0	40	60	100	3
3.	PCC	BMA302	Computer Aided Design-I	3	0	0	40	60	100	4
4.	PCC	BMA303	Strength of Material	3	1	0	40	60	100	3
5.	ESC	BEE301	Electronic Devices	3	0	0	40	60	100	4
6.	LC	BCS222	Basics of Python Laboratory	0	0	2	30	20	50	1
7.	LC	BMA322	Computer Aided Design-I Laboratory	0	0	4	60	40	100	1
8.	LC	BMA323	Strength of Material Laboratory	0	0	2	30	20	50	1
9.	LC	BEE321	Electronic Devices Laboratory	0	0	2	30	20	50	1
10.	PROJ	BRE300	Summer Training*	0	0	20	60	40	100	4
Total							**410**	**440**	**850**	**23**

***NOTE: The students will take 6weeks (120 hours) summer training after 2nd semester. The evaluation of this summer training will be done in the 3rd semester.**

Semester IV (Second Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	ESC	BEE402	Analog Circuits	3	0	0	40	60	100	3
2.	PCC	BEE403	Control System Engineering	3	0	0	40	60	100	3
3.	PCC	BEE305	Digital Electronics and Applications	3	0	0	40	60	100	3
4.	PCC	BMA403	Computer Aided Design-II	3	0	0	40	60	100	3
5.	PEC	BMA404	Kinematics and Dynamics of Machines	3	1	0	40	60	100	4
6.	LC	BEE422	Analog Circuits Laboratory	0	0	2	30	20	50	1
7.	LC	BEE423	Control System Engineering Laboratory	0	0	2	30	20	50	1
8.	LC	BEE325	Digital Electronics and Applications Laboratory	0	0	2	30	20	50	1
9.	LC	BMA423	Computer Aided Design-II Laboratory	0	0	4	60	40	100	2
10.	LC	BMA434	Kinematics and Dynamics of Machines Laboratory	0	0	2	30	20	50	1
Total							**380**	**420**	**800**	**22**

Semester V (Third Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	PCC	BRE502	Electrical Machines and Power Systems	3	0	0	40	60	100	3
2.	PCC	BMA405	Manufacturing Processes	3	0	0	40	60	100	3
3.	PCC	BRE601	Robot Kinematics and Dynamics	3	0	0	40	60	100	3
4.	PCC	BMA507	Industrial Automation	3	0	0	40	60	100	3
5.	PCC	BMA506	Metrology and Quality Control	3	0	0	40	60	100	3
6.	PEC		Elective-I	3	0	0	40	60	100	3
7.	LC	BRE522	Electrical Machines and Power Systems Laboratory	0	0	2	30	20	50	1
8.	LC	BMA435	Manufacturing Processes Laboratory	0	0	2	30	20	50	1
9.	LC	BRE621	Robot Kinematics and Dynamics Laboratory	0	0	2	30	20	50	1
10.	LC	BMA537	Industrial Automation Laboratory	0	0	2	30	20	50	1
11.	LC	BMA536	Metrology and Quality Control Laboratory	0	0	2	30	20	50	1
12.	PROJ	BRE500	Software/ Industrial Training*	0	0	20	60	40	100	2
13.	LC		Elective – I Laboratory	0	0	2	30	20	50	1
						Total	**480**	**520**	**1000**	**26**

*** NOTE: The students will take 6 weeks (120 hours) Software/Industrial training after semester 4th. The evaluation of this Software/Industrial training will be done in the 5th semester.**

Semester VI (Third Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	PCC	BMA601	Additive Manufacturing	3	0	0	40	60	100	3
2.	PCC	BMA605	Tool Design	3	0	0	40	60	100	3
3.	PCC	BRE606	Product Life Cycle Management	3	0	0	40	60	100	3
4.	PEC		Elective-II	3	0	0	40	60	100	3
5.	OEC		Open Elective-I	3	0	0	40	60	100	3
6.	HSMC		Humanities	3	0	0	40	60	100	3
7.	LC	BMA621	Additive Manufacturing Laboratory	0	0	2	30	20	50	1
8.	LC	BMA625	Tool Design Laboratory	0	0	4	60	40	100	2
9.	LC	BRE626	Product Life Cycle Management Laboratory	0	0	2	30	20	50	1
10.	MC	BMC003	Essence of Indian Traditional Knowledge	2	0	0	40	0	0	0
						Total	**400**	**440**	**840**	**22**

Semester VII (Fourth Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	PCC	BMA703	Computer Aided Engineering	3	0	0	40	60	100	3
2.	PCC	BRE602	PLC Programming	3	0	0	40	60	100	3
3.	PEC		Elective-III	3	0	0	40	60	100	3
4.	OEC		Open Elective-II	3	0	0	40	60	100	3
5.	PROJ	BRE700	Major Project	0	0	4	60	40	100	2
6.	LC	BMA723	Computer Aided Manufacturing Laboratory	0	0	4	60	40	100	2
7.	LC	BRE622	PLC Programming Laboratory	0	0	2	30	20	50	1
8.	LC		Elective-III Laboratory	0	0	2	30	20	50	1
						Total	**340**	**360**	**700**	**18**

Semester VIII (Fourth Year)

S. No.	Category	Course Code	Course Title	Hours per week			Marks Distribution			Credits
				Lecture	Tutorial	Practical	Internal	External	Total	
1.	PROJ	BRE800	Industrial Training	0	0	0	150	250	400	10
2.	PROJ	BRE801	Capstone Project	0	0	0	100	200	300	5
						Total	**250**	**450**	**700**	**15**

List of Professional Core Elective Courses

S. No.	Category	Course Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
Elective-I (Semester-V)								
1.	PEC	BRE441	Micro-controller and Micro-processor	3	0	0	3	3
2.	PEC	BRE442	Automobile Engineering	3	0	0	3	3
3.	PEC	BRE443	Data Structures and Algorithms	3	0	0	3	3
4.	PEC	BRE424	Micro-controller and Micro-processor Laboratory	0	0	2	2	1
5.	PEC	BRE425	Automobile Engineering Laboratory	0	0	2	2	1
4.	PEC	BRE426	Data Structures and Algorithms Laboratory	0	0	2	2	1
Elective-II (Semester-VI)								
1.	PEC	BRE741	Non-Destructive testing	3	0	0	3	3
2.	PEC	BRE743	Operation research	3	0	0	3	3
3.	PEC	BMA647	Tribology	3	0	0	3	3
4.	PEC	BRE745	Flexible manufacturing System	3	0	0	3	3
Elective-II (Semester-VII)								
1.	PEC	BEE034	Artificial Intelligence	3	0	0	3	3
2.	PEC	BRE749	Machine Learning	3	0	0	3	3
3.	PEC	BEE036	Internet of Things	3	0	0	3	3
4.	PEC	BRE724	Artificial Intelligence Laboratory	0	0	2	2	1
5.	PEC	BRE725	Machine Learning Laboratory	0	0	2	2	1
4.	PEC	BRE726	Internet of Things Laboratory	0	0	2	2	1

List of Humanities & Social Sciences including Management Courses:

S. No.	Category	Course Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1.	HSMC	COM101	English Communication	2	0	0	2	2
2.	HSMC	COM121	English Communication Lab	0	0	2	2	1
3.	HSMC	COM201	Business Communication	2	0	0	2	2
4.	HSMC	COM221	Business Communication Lab	0	0	2	2	1
5.	HSMC	HRM001	Human Resource Management	3	0	0	3	3
6.	HSMC	TQM001	Total Quality Management	3	0	0	3	3
7.	HSMC	HBW001	Human Behavior at Work	3	0	0	3	3
8.	HSMC	INP001	Industrial Psychology	3	0	0	3	3
9.	HSMC	ENS001	Environmental Studies	-	-	-	-	S/US (Non-Credit)

List of Open Electives for all B.tech Programmes

S.No.	Course Code	Course Name	L	T	P	Cr
1	BME031	Electric and Hybrid Vehicle	3	0	0	3
2	BME032	Industrial Ergonomics	3	0	0	3
3	BME033	Introduction to Hydraulics and Pneumatics	3	0	0	3
4	BME034	Basic Thermodynamics and Heat Transfer	3	0	0	3
5	BME035	Energy Conservation	3	0	0	3
6	BME036	Solar Energy Utilisation	3	0	0	3
7	BME037	Material Handling System	3	0	0	3
8	BME038	Production and Operation management	3	0	0	3
9	BME039	Safety and Hazard Analysis	3	0	0	3
10	BMA031	Entrepreneurship	3	0	0	3
11	BMA032	Operations Management	3	0	0	3
12	BMA033	Management Information System	3	0	0	3
13	BMA034	Basics of CAD	2	0	2	3
14	BMA035	Basics of Additive Manufacturing	2	0	2	3
15	BEE031	Simulation and Modelling	1	0	4	3
16	BEE032	Industrial Robotics and control	3	0	0	3
17	BEE033	Network Securities	3	0	0	3
18	BEE035	PLC and SCADA	3	0	0	3
19	BEE037	Biomedical Instrumentation	3	0	0	3
20	BEE038	Nano-Electronics	3	0	0	3
21	BAE031	Basics of Aerospace Engineering	3	0	0	3
22	BAE032	Basics of Aircraft Materials	3	0	0	3
23	QMD031	Quantitative methods for decision making	3	0	0	3

24	VAE031	Values and Ethics	3	0	0	3
25	EPI031	Economic Policies in India	3	0	0	3
26	FME031	Fundamentals of Management for Engineers	3	0	0	3
27	BCS041	Basics of Python Programming	3	0	0	3
28	BCS042	Introduction to Linux and Shell Programming	3	0	0	3
29	BCS043	Basics of Web Technologies	2	0	2	3
30	BCE031	Water pollution and its management	3	0	0	3
31	BCE032	Global warming and Climate Change	3	0	0	3
32	BCE033	Disaster Management and Mitigation	3	0	0	3
33	BCE034	Soil Chemistry and its impact	3	0	0	3
34	BCE035	Energy engineering technological and management	3	0	0	3
35	BCE036	Renewable energy technology	3	0	0	3
36	BCE037	Industrial pollution prevention and control	3	0	0	3
37	BCE038	Numerical method of Engineering	3	0	0	3

Summary of Credit Distribution
B.Tech Mechanical and Automation Engineering

S. No.	Course Area	Credits Per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	BSC	8	8	5	0	0	0	0	0	**21**
2.	ESC	6	7	6	3	0	0	0	0	**22**
3.	PCC	0	0	7	9	15	9	6	0	**46**
4.	PEC	0	0	0	4	3	3	3	0	**13**
5.	HUMANITIES	2	2	0	0	0	3	0	0	**7**
6.	OE	0	0	0	0	0	3	3	0	**6**
7.	LC	5	5	5	6	6	4	4	0	**35**
8.	PROJECT	0	0	0	0	2	0	2	15	**19**
	Total	**21**	**22**	**23**	**22**	**26**	**22**	**18**	**15**	**169**

15. Examination/Continuous Assessment System (CAS):

For CAS two assessment components are adopted to evaluate student's performance.

15.1 Internal Assessment, which includes attendance, mid semester examination and other components (Assignment, Snap Test, Project, Presentation/ Class Participation, Practical Lab Continuous Assessment, Quiz, Multiple Choice Questions, Case Study, Field Survey/Field Report etc.) carrying a weightage of 40%.

15.2 External Assessment i.e. End Semester Examination, carrying a weightage of 60%.

15.3 Internal Assessment of practical's i.e. Practical Lab Continuous Assessment, carrying a weightage of 60%.

15.4 External Assessment of practical's i.e., Practical Lab External, carrying a weightage of 40%

15.5 Every student has to score at least 25% marks each in Continuous Assessment and End Semester examination. The minimum pass percentage is 40% in aggregate. In case a student scores more than 25% each in Continuous Assessment and End Semester Examination, but overall percentage in the concerned subject remains less than 40%, then student has to repeat End Semester Examination in that subject.

16. Grading System: University follows eight letter grading system (A+, A, B+, B, C+, C, D, and F) that have grade points with values distributed on a 10 point scale for evaluating the performance of student. The letter grades and the corresponding grade points on the 10-point scale are as given in the table below.

Academic Performance	Range of Marks	Grades	Grades Points	Remarks
Outstanding	≥90	A+	10	
Excellent	≥80 & <90	A	9	
Very Good	≥70 & <80	B+	8	
Good	≥60 & <70	B	7	
Fair	≥50 & <60	C+	6	
Average	≥40 & <50	C	5	
Minimally Acceptable	40	D	4	
Fail	<40	F	0	
Incomplete		I	-	
Withdrawal		W		
Grade Awaited		GA	-	
Minor Project		**S/US**		S-Satisfactory US- Unsatisfactory

NB: The CGPA can be converted to percentage by using the given formula:

CGPA x 10 = %

e.g. 7.8 x 10 = 78%

Note: Cumulative Grade Point Average (CGPA), it is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (Course title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

15.6 Acceptance of MOOC courses

Faculty of Faculty of Engineering, Design and Automation accepts the MOOC course available on SWAYAM platform for credit transfer. 40% of the courses can be taken from the available list of MOOCs on SWAYAM.

Instructions for MOOC courses

a) MOOC courses taken for credit transfer must be approved and recommended by Dean Academics and Dean of the Faculty before the start of the semester.

b) The copy of the list of courses taken by the students for any course has to be submitted to the Controller of the Examination.

c) MOOC course should be done from SWAYAM platform as per the guidelines of UGC.

d) To obtain the credit the student needs to complete the assessment of the course and provide the certificate of the course issued by the SWAYAM/NPTEL. After completing the certificate, the student must submit the certificate within a week to the department.

e) The fees (if any) for the registration and / or assessment of the MOOC course must be borne by the student only.

f) The student can opt for a particular online MOOC course if and only if the credit of that course is equivalently mapped with the program structure.

g) If the student obtains the same course credit which mapped with the course, then credit shall be considered for this course and the grade/marks provided by the accessing authority shall be transfer to the student. The result of the MOOC shall be taken on record by the university examination cell and a result declared for these papers.

h) For any particular semester, all results for the MOOC course must be submitted along with the marks of other papers of the same semester by the course coordinator.

MOOC course coordinators shall be appointed for each of the course taken by the student.

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (Course title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

17. Re-appear: Student with backlog of one semester will be carried forward to next semester. Re-appear examinations will be conducted twice in a year after ESE of every semester.

18. Improvement of overall Score: A candidate having CGPA < 5.5 and wishes to improve his/her overall score may do so within two academic years immediately after passing nthe degree program by reappearing into maximum four course(s)/subject(s). The improvement would be considered if and only if the CGPA becomes > 5.5.

19. Program qualifying criteria: For qualifying the Program every student is required to earn prescribed credits 169. If any student fails to earn prescribed credits 169 for the program, then he/she will get a chance to complete his/her Program in two more years than the actual duration of degree.

In case of Under Graduate Engineering Courses regulated by AICTE, a range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student can opt for Honors Degree and Minor Engineering after the completion of first year (i.e. two semesters) and will be eligible to get Under Graduate degree with Honours (Core Courses) or additional Minor Engineering (Courses from other streams), if he/she completes an additional 20 credits. These could be acquired through MOOCs also.

20. Revision of Regulations, Curriculum and Syllabi: The University may revise, amend, change or update the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies and the Academic Council as and when required.

GNA UNIVERSITY
Inspiring Innovation.....

B.TECH. ROBOTICS AND AUTOMATION ENGINEERING

FACULTY OF ENGINEERING, DESIGN & AUTOMATION

(Applicable for 2022-2023 onwards)

BTC101: ENGINEERING CHEMISTRY
Credits: 4
LTP 310

Course Description: The course aims to equip the students with introduction to crystal field theory and spectroscopic properties, to understand the conditions of chemical equilibrium, periodic properties of elements, molecular shapes, and importance of stereochemistry in organic reactions and explore the synthesis of organic drug molecules.

The course includes quantum chemistry, co-ordination chemistry, solid states, and various spectroscopic techniques, states of matter, thermodynamic and periodic properties, stereochemistry and synthesis of drug molecules.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

Co1: Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and crystal field theory to explain aspects of structural, magnetic and spectroscopic properties.

CO2: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO3: Rationalize bulk properties and processes using thermodynamic considerations.

CO4: Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity and also list major chemical reactions that are used in the

synthesis of molecules.

Unit I

Atomic structure & Chemical Bonding: Schrodinger equation. Particle in a box solution and their applications for conjugated molecules. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbital theory- general introduction and the energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory- general introduction and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Unit II

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules – Electronic spectroscopy. Fluorescence and its applications in medicine. IR & microwave (Vibrational and rotational spectroscopy of simple diatomic molecules) Applications. Nuclear magnetic resonance and magnetic resonance imaging proton NMR, surface characterization techniques (FTIR & XRD).

Unit III

Thermodynamics: Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Unit IV

Polymers: General introduction, classification of polymers, Mechanism of addition and condensation polymerization, Idea of number average and weight average molecular masses of polymers, Properties and uses of polystyrene, polyester, polyamide, epoxy, phenol-formaldehyde and silicon resins.

Stereochemistry: Representations of three-dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality in organic molecules, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Organic reactions and synthesis of a drug molecule: Introduction to simple reactions substitution, addition, elimination, oxidation, reduction and cyclization's. Synthesis of a commonly used drug molecules (Aspirin, Metronidazole, Ciprofloxacin).

Recommended Books / Suggested Readings:

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
http://bcs.whfreeman.com/vollhardtschore5e/default.asp

BEM101: ENGINEERING MATHEMATICS - I

Credits : 4

LTP 310

Course Description: The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra and equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (CO):

After completion of this course students will be able to -

1. Apply fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
2. The essential tool of matrices and linear algebra in a comprehensive manner
3. Use mathematical tools needed in evaluating multiple-integrals and their usage.
4. Use mathematical tools needed in evaluating multiple integrals and their usage.

Unit I

Calculus: Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Unit II

Matrices: Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem.

Unit III

Multivariable Calculus (Differentiation): Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Unit IV

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates, Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss, and Stokes (without proofs).

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(iii) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
(iv) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Readings:

I. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
ii. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
iii. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

BCS302: OBJECT ORIENTED PROGRAMMING USING C++

Credits : 3

LTP 300

Course Description: This course equips the students with the understanding of the concepts of object-oriented language and the problems in real world using the concept of classes and objects using programs in C++.

Course Outcomes (CO):

1. To perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
2. To demonstrate adeptness of object oriented programming in developing solutios to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
3.To demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
4. To learn syntax, features of, and how to utilize the Standard Template Library.
5. To study the concepts of Assembler, Macro Processor, Loader and Linker

Course Content

Unit I

Introduction and Building blocks of C++: Basics concept of C ,Difference between C and C++,Introduction of C++, Classification of Computer languages, Programming techniques, Features of Object Oriented Programming, Process of language translation, Data types, Operators and Expressions: Tokens, Identifiers, Keywords, Data types, Operators, Expressions, Type Casting, Structure of C++ Program, Input Output Operator, Comments, Errors in C++ Program, Introduction to Conditional Statements (if , if-else, conditional, Switch statements), Loop statements (while, do-while, for), break, continue, GOTO statement, Preprocessors and Manipulators: Preprocessor, Types of Preprocessor Directives, Manipulators

Unit II

Functions, Arrays, Strings, Structure and Union: Definition of function, Advantages of Functions, Function Definition, Function Declaration, Function Call, Return statement, Pass by value, Pass by reference, Default arguments, Recursion, Storage Classes, Function Overloading, Inline function, Arrays, One-Dimensional, Multi-Dimensional, Declaration of Arrays, Initializing an Array, Processing the elements of an array, Strings Character Array.

Unit III

Classes and Objects: Concept of Classes and Objects, Access Specifiers, General template of a Class, Writing body of member function outside the class, creation of objects, Constructor, Need of Constructor, General syntax of a constructor, declaration of constructor, Classification of constructor, destructors, Concept of Pointers, Declaration of Pointer, Defining pointer variable.

Unit IV

Inheritance and Polymorphism: Introduction, Advantages of Inheritance, Access Specifiers in Inheritance, Types of Inheritance, Abstract Classes, Difference between Abstract Method and Virtual Method, Static Vs dynamic polymorphism.

File Handling: C++ Stream Classes, Opening and Closing files, Read and Write functions

Text Books:

1. Lafore R., Object Oriented Programming in C++, Waite Group
2. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill
3. R. S. Salaria, Mastering Object-Oriented Programming with C++, Salaria Publishing House

Suggested Readings:

1. Bjarne Stroustrup, The C++ Programming Language, Addison Wesley
2. Herbert Schildt, The Complete Reference to C++ Language, McGraw Hill-Osborne
3. Lippman F. B, C++ Primer, Addison Wesley

BME101: ENGINEERING DRAWING & GRAPHICS-2D

Credits : 3

LTP 104

Course Description: The course aims to equip the students with basic concept of engineering drawing for the visualization of technical graphics, geometrical objects and engineering objects following standards and conventions of engineering drawing.

The course includes letter writing, dimensioning, various types of scales, orthographic projection of points, lines and plane surfaces, AutoCAD – 2D sketching and editing.

Course Outcomes (CO):

After completion of this course students will be enable to -

CO1: Construct a scale, understand and apply the principles of dimensioning, and learn the use of various types of lines used in engineering drawing.

CO2: Explain the quadrant system used for orthographic projections and produce orthographic projections of points and lines.

CO3: Produce orthographic projection of regular plane figures - triangle, square, rectangle, rhombus, pentagon, hexagon, etc.

CO4: Use various tools of AutoCAD such as draw, modify, etc. and prepare 2D – sketches.

Course Content

Unit I

Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing,

Unit II

Orthographic Projections Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes

Unit III

Orthographic Projections of Plane Surfaces (First Angle Projection Only) Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only.

Unit IV

Overview of AutoCAD: Basic fundamentals of Computer hardware and software, Discussion and Advantages about CAD Technology, Basics of drafting, Orthographic views, Isometric views, Section View, Paper sizes, dimensioning types, Introduction to AutoCAD Getting Started with AutoCAD.

Introduction of 2D sketching: Line, Polyline Arc and its type, Circle and its type, Rectangle, Ellipse and its types, Spline, Construction line, Ray and its type, Divide, Measure, Region, Cloud, Hatch, Gradient, Boundary, Move, Rotate

Basic Editing Tools: Trim, Extend, Copy, Mirror, Fillet, Chamfer, stretch, Scale, Explode, Erase, Offset, Join, Delete, Text, Multiple text, Single line text, Linear, Aligned, Angular, Arc length, Radius, Diameter, Jogged, Add leader , Remove leader, Align, Insert, Create, Edit Text style, Dimension style, Leader style, , Grid, Ortho, Polar, Snap, Track.

List of Experiments:

1. Page setup and unit system (limits and units setup).
2. Generate 2D sketch for production drawing.
3. Practice of various wireframe models (2D).

Recommended Books / Suggested readings:

1. Engineering Drawing & Computer graphics by P.S.GILL
2. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48thedition, 2005-Charotar Publishing House, Gujarat.
3. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K International Publishing House Pvt. Ltd., New Delhi, 3rdrevised edition- 2006.
4. Engineering Drawing & Computer graphics by Harwinder Singh, Dhanpat Rai Publishing Company.
5. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
6. D.M. Kulkarni, A. P. Rastogi, and A. K. Sarkar (2009), Engineering Graphics with AutoCAD,PHI Learning Private Limited, New Delhi.
7. Jolhe, Dhananjay (2006), Engineering Drawing: With an Introduction to CAD, Tata Mc GrawHill, India.

COM101: ENGLISH COMMUNICATION

Credits : 2

LTP 200

Course Description: The course aims to make students capable of using English language in context, and enhance effective reading and writing skills.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: The students will develop a minute practical knowledge about English grammar and its usage.

CO2: The students will develop an understanding of the importance of free expression.

Course Content

1. Reading Skills: Comprehension of Unseen Passage [Reading articles](Intermediate)Summary Paraphrasing, Translation and Precis Writing

2. English Grammar and Usage: Parts of speech, common errors in writing (based on Parts of Speech) Tenses, Change of Voice, Transformation of Sentences

3. Basic Writing Skills and Writing Practices:Paragraph/essay writing, short life story writing, Notice (General like trip, change of name, function) making notes and Letter writing

4. Vocabulary Enhancement: Synonym, Antonym, Idioms and Phrasal verbs.

Recommended Books / Suggested Readings:

1. *Practical English Usage.* Michael Swan OUP. 1995
2. *On Writing Well. William Zinsser.* Harper Resource Book. 2001
3. *Communication Skills.* Sanjay Kumar and PushpLata.Oxford University Press. 2006
4. *Exercises in Spoken English.* CIEFL, Hyderabad. Oxford University Press
5. https://www.englishgrammar101.com/
6. http://learnenglish.britishcouncil.org/en/english-grammar
http://www.englishgrammarsecrets.com/
7. http://www.myenglishpages.com/
8. http://www.myenglishpages.com/
3. http://www.english-for-students.com/Homonyms-B.html

BME121: WORKSHOP PRACTICE

Credits : 2

LTP 004

Course Description: The course aims to make the students understand various tools, equipment and safety instructions used while performing various workshop practices in carpentry, fitting, electrical, and sheet metal work and also enabling them to acquire skills to perform these workshop practices.

This course includes hands on training on carpentry, fitting, electrical, and sheet metal work.

Course Outcomes (CO):

After completion of this course students will be enable to -

Co1: Explain the safety instructions to be followed while performing various workshop practices – wood working, forging, machining, welding, etc.

CO2: Identify and demonstrate the application of various tools and equipment used in workshop shop.

CO3: Demonstrate practical knowledge by performing various manufacturing operations in carpentry shop and fitting shop.

CO4: Demonstrate practical knowledge by performing various manufacturing operations in electrical shop, and sheet metal shop.

Course Content

Unit I

Carpentry Shop: Introduction; wood, timber, types of wood, seasoning of wood, Carpentry tool, Wood working machines, Defects in wood. Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to be observed, Introduction to various types of wooden joints, their relative advantages and uses. Demonstration of various methods of painting wooden items.

Unit II

Fitting Shop: Introduction to fitting shop tools, common materials used in fitting shop, Identification of materials. (e.g. Steel, Brass, Copper, Aluminium etc.).Identification of various sections of steel such as Flat, Angle, Tee, Channel, Bar Girder, Square, Z-Section, etc. Description and demonstration of various types of work benches. holding devices and files. Precautions while filling. Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting the blade. Introduction to various types of threads (internal, external)-single start, multi-start, left hand and right hand threads. Description and demonstration of various types of drills, taps and dies Selection of dyes for threading, selection of drills and taps for tapping operations.

Unit III

Electric Shop: Introduction; various electrical materials, Tools & Various electrical instruments used in electric shop, Concept of wiring. Introduction to the construction of a Lead-acid battery and its working. Installation of a battery and to connect two or more batteries in series and in parallel, Charging of a battery and testing it with the help of hydrometer and Cell Tester. Importance of three-phase wiring and its effectiveness. Estimating and costing of power connection.

Unit IV

Sheet metal Shop: Introduction; types of sheets, Tools used in sheet metal shop, Sheet metal operations. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

Recommended Books / Suggested Readings:

1. Workshop Technology Part 1-3 by Chapman W A J , Viva Books Pvt. Ltd, New Delhi
2. Work Shop Technology by Raghuwanshi R S, Dhanpat Rai and Sons, New Delhi
3. Production Technology by Jain R K, Khanna Publishers, New Delhi

BTC121: ENGINEERING CHEMISTRY LABORATORY

Credits : 1

LTP 002

Course Description: The course aims to equip the students with experimental/practical knowledge of illustrating the principles of chemistry relevant to the study of science and engineering.

The course includes separation techniques, determination of ions in water, rate constants for chemical reactions, cell constants, conductometry, potentiometry, chemical analysis, saponification and chemical oscillations.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Estimate rate constants of reactions from concentration of reactants/products as a function of time

CO2: Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc

CO3: Synthesize a small drug molecule/polymers and analyze a salt sample

CO4: To analyses the inorganic salts and chromatography for separation of compounds.

List of Experiments:

Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to demonstrate isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

BCS322: OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY

Credits : 1

LTP 002

Course Description: The course aims to equip the students with the basic programming and error correction. The course helps students to solve real life problems.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify and correct logical errors encountered at run time

CO2: Use concepts of Object Oriented Programming

CO3: Create, read and write to and from simple text files.

List of Experiments:

1. Program to calculate the sum of two numbers.
2. Program to find area and circumference of circle.
3. Program to calculate area and perimeter of a rectangle.
4. Program to find reverse of a number.
5. Program to find a greater number between two numbers using if statement.
6. Program to find a greater number between two numbers using if else statement.
7. Program to find a greater number between two numbers using ternary operator.
8. Program to find the greatest number among three numbers using if else statement.
9. Program that reads a no. between 1 to 7 and then print the day corresponding to that number.
10. Program to add, subtract, multiply and divide two numbers using switch.
11. Program to use for loop to print values of a from 10 to 19.
12. Program to use While loop to print values of a from 10 to 19
13. Program to use do while loop to print values of a from 10 to 19.
14. Program to display the letter d continuously unless someone or somebody stops by typing.
15. Program to skip the number 5 in the countdown 10 to 1.
16. Program to print the numbers 10 to 1 using Go to loop.
17. Program to illustrate the use of set precision () manipulator.
18. Program to calculate the multiplication of two numbers by using function.
19. Program using functions by passing values call by values method.
20. Program using functions by passing call by reference method.

COM121: English Communication Lab

Credits : 1

LTP 002

Course Description: : The course aims to equip the students with focus on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

The course includes description of sights seen in everyday life, pronunciation of different words and its correct usage.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Better understanding of nuances of English language through audio- visual experience and group activities

CO2: Speaking skills with clarity and confidence enhancing their employability skills

CO3: Better comprehension of speech of people of different backgrounds and regions.

CO4: Ability to use English grammar accurately.

Course Content

1. Daily Discourse: Common Everyday Situations: Conversations and Dialogues (Unit 1-6), Monologue (2D/4D/5D/6D), and Communication at workplace.
2. Listening skills on Social Interactions (Unit 1), work and study (Unit 2), daily life (Unit 3), food (Unit 4), Places (Unit 5) and Family (Unit 6)
3. Phonetic Skills: Pronunciation, Intonation, Stress (Unit 1-6) and Rhythm
4. Speaking Skills: Group Discussion / Debate, Role Plays

Recommended Books / Suggested Readings:

1. *Cambridge English Empower Elementary Student's Book by Cambridge University PressOn Writing Well. William* Zinsser. Harper Resource Book. 2001
2. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
3. Study Writing. Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.2006.
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Practical English Usage. Michael Swan. OUP. 1995.

ENS001: Environmental Studies

Credits : U/US

LTP 200

Course Description: This course deals with the environment components, ecosystems and how to maintain equilibrium in nature, its conservation, and different methods to reduce pollution and maintain our nature.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand about environment, its role and importance for living beings.

CO2: Understand the structure of ecosystem, food chain/ web.

CO3: Understand about the natural resources and their uses.

CO4: Understand about different types of pollution created by human beings and their side effects as well as the methods to reduce these pollutions and their alternatives.

Course Content

Unit I

Introduction to environmental studies: Multidisciplinary nature of environmental studies; components of environment –atmosphere, hydrosphere, lithosphere and biosphere, Scope and importance; Concept of sustainability and sustainable development.

Ecosystems: What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit II

Natural Resources:Renewable and Non-renewable Resources:

- Land Resources and land use change; Land degradation, soil erosion and desertification
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity, and tribal populations.

• Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

• Heating of earth and circulation of air; air mass formation and precipitation.

• Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Biodiversity and Conservation

• Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots

• India as a mega-biodiversity nation; Endangered and endemic species of India

• Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

• Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit III

Environmental Pollution

• Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution

• Nuclear hazards and human health risks

• Solid waste management: Control measures of urban and industrial waste.

• Pollution case studies.

Environmental Policies & Practices

• Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

• Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC).

• Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context.

Unit IV

• **Human Communities and the Environmen**t

• Human population and growth: Impacts on environment, human health, and welfares.

• Carbon footprint.

• Resettlement and rehabilitation of project affected persons, case studies.

• Disaster management: floods, earthquakes, cyclones, and landslides.

• Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.

• Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

• Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

**** Field work**

• Visit to an area to document environmental assets; river/forest/flora/fauna, etc.

• Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.

• Study of common plants, insects, birds, and basic principles of identification.

• Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.

2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.

3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.

4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.

5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principles of Conservation Biology.Sunderland: Sinauer Associates, 2006.

6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.

7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.

8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

9. Odum, E.P., Odum, h.T.& Andrews, J.1971. Fundamentals of Ecology. Philadelphia: Saunders.

10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.

11. Rao, M.N. & Datta, A.K. 1987. Wastewater Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.

12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.

13. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.

14. Sengupta, R. 2003.Ecology and economics: An approach to sustainable development. OUP.

15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.

17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.

18. Warren, C.E. 1971. Biology and Water Pollution Control. WB Saunders.

19. Wilson, E.O. 2006. The Creation: An appeal to save life on earth. New York: Norton.

20. World Commission on environment and Development. 1987. Our Common Future. Oxford University Press.

21. www.nacwc.nic.in

22. www.opcw.org

BTP101: ENGINEERING PHYSICS

Credits: 4

LTP 310

Course Description: The aim and objective of the course is to aid in quantification the several concepts in Physics that have been introduced at the 10+2 levels in schools and to provide firm foundation in various aspects of Physics.

This course includes the basics of Mechanics, Optics and Electromagnetism so that they can use these in Engineering as per their requirement.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand various coordinate systems and oscillators.

Co2: Describe the static and dynamic electric and magnetic fields for technologically important structures.

CO3: Acquire the knowledge of Maxwell equation and electromagnetic field theory and propagation and reception of electro-magnetic wave systems.

CO4: Recognize physical phenomenon in the context of strength of materials

Course Content

Unit I

Physical significance of gradient, Divergence and curl. Potential energy function; F = - Grad V, equipotential surfaces. Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law. Introduction to Cartesian, spherical and cylindrical coordinate system. Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams

Mechanical and electrical simple harmonic oscillators, damped oscillations, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, resonance.

Unit II

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of

electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their

solution and connection with steady state diffusion and thermal conduction; Practical examples like

Farady's cage and coffee-ring effect.

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Unit III

Faraday's law; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law; energy stored in a magnetic field. Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displacement current and magnetic field arising from time-dependent electric field; Maxwell's equation in vacuum and non-conducting medium; Flow of energy and Poynting vector and Poynting theorem.

Unit IV

Friction: Definitions: Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; motion on horizontal and inclined planes. Methods of reducing friction, Concept of stress and strain at a point; Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding), one dimensional stress-strain curve; Generalized Hooke's law. Force analysis — axial force, shear force, bending moment and twisting moment. Bending stress; Shear stress; Concept of strain energy; Yield criteria.

Recommended Books / Suggested Readings:

1. Engineering Mechanics, 2nd ed. — MK Harbola
2. Introduction to Mechanics — MK Verma
3. David Griffiths, Introduction to Electrodynamics
4. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
5.B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
6. A. Ghatak, “Optics”, McGraw Hill Education, 20

BEM201: ENGINEERING MATHEMATICS - II

Credits: 4

LTP 310

Course Description: The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations, and complex variables and equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes (CO):

After completion of this course students will be enable to -

1. The convergence of sequence and series and to apply different tests of convergence
2. Apply effective mathematical tools for the solutions of differential equations in engineering problems.
3. Apply a range of techniques to find solutions of standard Partial Differential Equations (PDE) and understand the basic properties of standard PDE's.
4. Solve boundary value problems related to Laplace, heat and wave equations by various methods.

Unit I

Sequences and series: Convergence of sequence and series, tests for convergence of positive term series: root test, ratio test, p-test, comparison test; Alternate series and Lebinitz's test; Power series, Taylor's series, series for exponential, trigonometric and logarithmic functions.

Unit II

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters.

Unit III

Partial Differential equations of second order: Homogeneous and Non-Homogeneous linear Partial differential equation with constant coefficients, Rules for Finding C.F ad P.I.(for both); Equation reducible to partial differential equation with constant coefficients, classification of

linear PDE of second order.

Unit IV

Principle of superposition; method of separation of variable; one dimensional and two dimensional- wave equations, Laplace equation and heat equation and its solutions.

Textbooks:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

Suggested Readings:

1. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.

3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

BEE101: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Credits: 4

LTP 310

Course Description: The course aims to equip the students with the basic concepts of electricity, electrical components and their applications. Also explain the working principle, construction, applications of various electrical machines.

The course includes the basic fundamentals of electronic components, devices and transducers, principles of digital electronics and concepts of basic electricity and electrical circuits which includes SCR, Transformer, magnetic circuits etc.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Students of all branches have to deal with the applications of Electrical Engineering and Electronics Engineering. This knowledge give them a brief outline of the fundamentals that would be the foundations of today's and tomorrow's technology.

CO2: Students should be able to understand new trends in Electronics and Electrical Engineering.

CO3: Students impart detail knowledge of basic electronics, digital electronic concepts etc.

CO4: Student will get practical knowledge of electronics instruments, components and their specifications, uses etc.

CO5: Analyze and solve electric and magnetic circuits, Identify functions of digital multimeter, cathode ray oscilloscope and various devices in the measurement of physical variables.

Course Content

Unit I

Fundamentals of dc circuits: Introduction of CRO and multimeter, fundamentals of electricity (current, voltage, inductor, capacitor, resistor), ohm's law, Kirchhoff's' current and voltage law, series and parallel resistances and their circuit analysis. Elementary calculations for energy consumption and power factor improvement.

Unit II

Fundamentals of ac circuits: AC circuits (generation, AC values, waveforms), Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive

power, apparent power, power factor. AC circuits (resistive, capacitive, inductive circuits), Impedance, admittance, polar form and rectangular form in AC circuits.

Unit III

Principles of Magnetic circuits and transformers: Magnetism and transformers (Electromagnetic Induction, Mutual Induction), Working of Transformers (operation, principle turns ratio and applications), Losses in transformers, Rating and emf equation of transformers. Laws and terminologies in magnetic circuits.

Unit IV

Electrical Installations & Power Converters: Components of LT Switchgear: Fuse, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing and grounding. Batteries & UPS and its types. Introduction to SCR, DIAC, TRIAC and its VI characteristics.

Unit V

Basics of Electronics: Introduction to Semi-Conductor materials (PN junction diodes, biasing and construction of PN Diode, Zener diode and its applications), Bipolar Junction Transistors (Construction, Working, configurations of Transistor and Applications).

Unit VI

Digital Electronics: Introduction, number system and conversion, basic logic gates and their truth tables, Flip-Flop's, Half and full adder, Half and full subs tractor, Multiplexer and De multiplexer encoder, Decoder.

Recommended Books/ Suggested Readings:

1. B.L THAREJA , Fundamentals of Electrical engineering and electronics, S.CHAND 1st 2013.
2. EARL GATES , Introduction to electronics, DELMAR CENGAGE LEARNING, 6th edition 2013.
3. J.B GUPTA , Basic electrical and electronics engineering, S.K Kataria and sons edition 2013.
4. Basic Electrical and Electronics and Computer Engineering by R Muthusubramanian, S Salivahanan,K A Muraleedharan, Tata McgrawHill.
5. Basic electrical and electronics engineering DP KOTHARI 4TH EDITION 2013 MC Graw Hill.
6.https://www.scribd.com/doc/90182505/BEEE-Notes
7.http://www.kinindia.net/23-ge6252-basic-electrical-and-electronics-engineering-notes/
8.https://www.studynama.com/community/threads/239-Basic-electrical-electronics-engineering-ebook-pdf-lecture-notes
9. http://www.freebookcentre.net/Electronics/Basic-Electronics-Books.html
10.http://www.freeengineeringbooks.com/Electrical/Basic-Electrical-Engineering.php

BME201: ENGINEERING DRAWING AND GRAPHICS -3D

Credits: 3

LTP 104

Course Description: The course aims to equip the students with basic concept of engineering drawing of three dimensional objects for the visualization of technical graphics, geometrical objects and engineering objects following standards and conventions of engineering drawing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Prepare orthographic drawings of various polyhedral and solids of revolution such as prisms, pyramids, cones etc.

CO2: Develop the lateral surfaces of solids which is of utmost requirement in sheet metal work.

CO3: Convert orthographic view into isometric one and vice-versa.

CO4: Perform 3D-modeling using AutoCAD.

Course Content

Unit I

Projections of Solids (First Angle Projection Only) Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.

Unit II

Sections And Development of Lateral Surfaces of Solids: Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.

Unit III

Isometric Projection (Using Isometric Scale Only) Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms , pyramids, cylinders, cones, spheres, cut spheres.

Unit IV

AutoCAD

Advanced Editing Tools: Array, Path array, Polar array, Layer setup, Lock, Freeze, Hide, Unhide,

Table, Make up, Annotation, Scaling, Snap, Page Setup, Plot, Batch Plot, Export, DWF, DXF, Pdf, Dwt (drawing template)

Dimensioning: Basic Dimensioning, Geometric Dimensioning and Tolerances, Editing Dimensions, Dimension styles and Dimensioning System Variables, Plotting Drawings, Hatching Drawings, Working with Layers and Blocks

3D Modelling: Overview of 3D modelling, Extrude, Subtract, Intersect, Solid union, Box , Cylinder, Cone, Sphere , Wedge, Sweep, Layer, Layer properties, 3D object snap, Selection cycling, 3D rotate view, Orbit.

List of Experiments:

1. Practical demonstration about dimension style, text style and layer setting.
2. Printing and plotting setup according to paper size of production drawing.
3. Design of knuckle joint
4. Design of jib & cotter joint
5. Design of universal joint

Recommended Books / Suggested readings:

1. Engineering Drawing & Computer graphics by P.S.GILL
2. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48thedition, 2005-Charotar Publishing House, Gujarat.
3. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K International Publishing House Pvt. Ltd., New Delhi, 3rdrevised edition- 2006.
4. Engineering Drawing & Computer graphics by Harwinder Singh, Dhanpat Rai Publishing Company.
5. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
6. D.M. Kulkarni, A. P. Rastogi, and A. K. Sarkar (2009), Engineering Graphics with AutoCAD,PHI Learning Private Limited, New Delhi.
7. Jolhe, Dhananjay (2006), Engineering Drawing: With an Introduction to CAD, Tata Mc GrawHill, India.

COM201: BUSINESS COMMUNICATION

Credits: 2

LTP 200

Course Description: To make students develop business writing etiquette in terms of formats and develop their reading skills and enhance their vocabulary

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: The students will be able to develop effective reading and writing skills.

CO2: The students will learn vocabulary and technical jargons as used in business communication.

Course Content

1. Theory of Communication: Process of Communication,Verbal and Non-verbal communication, Modes of Communication, and Barriers to Communication.
2. Nature and Style of sensible Writing: Memorandum, Notices, Quotations/Tenders, Report Making, Minutes of Meeting, E-Mail, Press Note, Resume, Complaint Letter, Inquiry Letter, Cover Letter, Confirmation Letter, Resignation Letter, Permission Letter and Job Application
3. Vocabulary Building: Words Often Confused and Words Often Misspelt, standard abbreviations, word formation, prefix, suffix, root words from foreign languages, punctuation, phrases and clauses
4. Grammar: Conditional Sentences, and Degrees of Comparison.

Recommended Books / Suggested Readings:

1. *Cambridge English Empower Elementary Student's Book by Cambridge University Press*
2. *Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press*
3. Study Writing. Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.2006.
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. *Practical English Usage.* Michael Swan. OUP. 1995.

BME122: MANUFACTURING PRACTICES

Credits: 2

LTP 004

Course Description: The course aims to make the students understand various tools, equipment and safety instructions used while performing various workshop practices in welding, machining, smithy, and foundry work and enabling them to acquire skills to perform these workshop practices.

This course includes hands on training on welding, machining, forging, and casting operations.

Course Outcomes (CO):

After completion of this course students will be enable to -

CO1: Explain the safety instructions to be followed while performing various workshop practices – wood working, forging, machining, welding, etc.

CO2: Identify and demonstrate the application of various tools and equipment used in workshop shop.

CO3: Demonstrate practical knowledge by performing various manufacturing operations in carpentry shop and fitting shop.

CO4: Demonstrate practical knowledge by performing various manufacturing operations in electrical .

Course Content

Welding Shop: Introduction; Types of welding; introduction to welding equipment e.g. a.c. welding set, d.c. rectifier, Electrode holder, electrodes and their specifications, welding screens and other welding related equipment and accessories. Types of welding joints, Concept of Gas welding; Arc welding; MIG welding; TIG welding; Spot welding, Seam welding, Different welding position, Soldering and Brazing.

Machine Shop: Introduction; types of machines, Lathe machine; Parts, specifications, operations performed on Lathe, Shaper; Parts, operations performed on Shaper, Drilling machine; Parts, operations performed on Drilling machine, Milling machine; types of milling machines; parts; operations performed on a Milling machine.

Smithy Shop: Introduction; Forging tools and equipment, Hot working process; Cold working process. Forging operations in Smithy shop. Safety measures to be observed in the smithy shop. Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing etc.

Foundry shop: Introduction; various terms used in casting, Tools and equipment used in casting shop, Patterns Moulding and Casting processes.

Recommended Books

1) Workshop Technology Part 1-3 by Chapman W A J , Viva Books Pvt. Ltd, New Delhi

2) Work Shop Technology by Raghuwanshi R S, Dhanpat Rai and Sons, New Delhi

3) Production Technology by Jain R K, Khanna Publishers, New Delhi

4) Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd. New Delhi

5) Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi

BTP121: ENGINEERING PHYSICS LABORATORY

Credits: 1

LTP 004

Course Description: It draw the connection between theoretical knowledge and its application in the context of analyzing various electronic circuits and their components.

Course Outcomes (CO):

1. The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.
2. The student will be enabled to know about the characteristics and the behavior of various materials in a practical manner and gain knowledge about various communication mediums and its usage.

Choice of 10-12 experiments from the following:

List of Experiments:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To find the quality factor of a damped harmonic oscillator.
3. To study one dimensional collision using two hanging spheres of different materials.
4. To determine the Moment of Inertia of a Flywheel.
5. To find out the frequency of AC mains using electric–vibrator.
6. To determine g by Bar Pendulum.
7. To determine g by Kater's Pendulum
8. To study the magnetic field of a circular coil carrying current.
9. To study B–H curve using CRO.
10. To find out dielectric constant of a dielectric substance.
11. To study the laser beam characteristics like; wave length using diffraction grating aperture
12. To determine numerical aperture of an optical fibre.
13. To determine attenuation & propagation losses in optical fibres.
14. To find the refractive index of a material using spectrometer.
15. To determine the grain size of a material using optical microscope.

Physics virtual lab:

1. To study Zener diode voltage as regulator and measure its line and load regulation.
2. To study the B-H Curve .
3. To draw the static current-voltage (I-V) characteristics of a junction diode
4. To determine the resistivity of semiconductors by Four Probe Method.
5. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.
6. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.

BEE121: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

Credits: 1

LTP 002

Course Description: The course aims to equip the students with knowledge on electrical and electronic equipment's to perform various electrical and electronics practical's and projects. The course includes various kits like SCR, Transformers, Transistors kit, PN junction diodes, Digital electronics kits etc.

Course Outcomes (CO)

Upon successful completion of the course, the students should be able to:

CO1: Students will able to handle basic electrical equipment.

CO2: Students will able to do staircase wiring.

CO3: Students will able to understand domestic wiring procedures practically.

CO4: Student will able to assemble electronic systems.

CO5: Students will understand all the fundamental concepts involving electrical engineering.

CO6: Students will understand all the fundamental concepts involving electronics engineering.

Course Content

List of Experiments

1. To verify ohm's law and its limitations
2. To calculate the resistances and verify ohm's law for the wires of different material
3. To calculate the resistances of colored resistors
4. To verify Kirchhoff's current and voltage law
5. To study the various functions of CRO and calculate the amplitude and frequency of a sine wave using CRO.
6. To measure power and power factor in a single phase ac circuit.
7. To find out voltage – current relationship in a R-L-C series and parallel circuit and determine the resonance frequency of the circuit
8. To measure the resistance and inductance of a coil by ammeter- voltmeter method.
9. To obtain the characteristics of a pn junction diode.
10. To verify the application of zener diode as a voltage regulator
11. To verify the input and output characteristics of CE, CB and CC npn transistor.
12. To verify the functioning of a transistor as an amplifier
13. To verify the truth table of the various logic gates
14. To study the BCD to decimal encoder kit.

COM221: BUSINESS COMMUNICATION LAB

Credits : 1

LTP 002

Course Description: The course aims to equip the students with business communication principles through creation of effective business and oral presentations. Includes study and application of team communication and use of technology to facilitate the communication. The course includes designing and mastering the most important communication skills, from professional writing presentations.

Course Outcomes (CO)

Upon successful completion of the course, the students should be able to:

CO1: Acquire in-depth knowledge of principles of business communication.

CO2: Discuss the use of video in business messages

CO3: Deliver high-quality oral presentations

CO4: Nonverbal communication, interview preparation, resume writing

Course Content

1. Listening Skills: Listening Exercises on Journeys (Unit 7), Fit and healthy (Unit 8), Clothes and shopping (Unit 9), Communication (Unit 10), Entertainment (Unit 11) and Travel (Unit 12)
2. Presentation Skills: Making PPT and Presenting Power Point Presentation
3. Phonological Skills: Pronunciation, syllables and word stress. Vocabulary Enhancement: Synonym, Antonym, Idioms and Phrasal verbs.
4. Speaking Skills: Interview skills.

Recommended Books / Suggested Readings:

10. *Cambridge English Empower Elementary Student's Book by Cambridge University PressOn Writing Well. William Zinsser.* Harper Resource Book. 2001
11. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
12. Study Writing. Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.2006.
13. On Writing Well. William Zinsser. Harper Resource Book. 2001
14. Practical English Usage. Michael Swan. OUP. 1995.

BMC001: Constitution of India

Credits: 0 (S/US)

LTP 200

Course Contents:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

BMC001: Constitution of India

Credits : 5 (S/US)

LTP 200

Course Contents:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

BEM301: ENGINEERING MATHEMATICS - III

Credits :5

LTP 410

Course Description: The objective of this course is to familiarize the prospective engineers with transformation equations and discrete structures. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their discipline

Course Outcomes (CO)

1. The mathematical tools needed in evaluating Fourier and Laplace Transformations and their usage.
2. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context
3. Apply concepts of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. Deal with functions of several variables that are essential in most branches of engineering.

Course Content

Unit I

Transform Calculus - I: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem.

Transform Calculus – II: Fourier series: Half range sine and cosine series, Fourier transforms: properties, methods, inverses and their applications.

Unit II

Partially ordered sets: Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices. Boolean and pseudo-Boolean lattices.

Unit III

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

Unit IV

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,2000.
4. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
5. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
6. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
7. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
8. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007.
9. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010.
10. N. Deo, Graph Theory, Prentice Hall of India, 1974.
11. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
12. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

BCS 209: BASICS OF PYTHON

Credits : 3

LTP 300

Course Description: Computer programming skills are now becoming part of basic education as these skills are increasingly of vital importance for future job and career prospects. The Python programming language which is one of the most popular programming languages worldwide. The course shows you how to use the free open-source Python to write basic programs and high-level applications using concepts such as Class, BIF of Python, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and algorithms such as the Insertion Sort algorithm. This course will be of great interest to all learners who would like to gain a thorough knowledge and understanding of the basic components of computer programming using the Python language – and might be a gentle introduction to programming for those who think they might have a longer-term interest in the subject area.

Course Outcomes (CO):

CO1: Able to apply the principles python programming.
CO2: Write clear and effective python code.
CO3: Create applications using python programming.
CO4: Implementing database using SQLite.
CO5: Access database using python programming.
CO6: Develop web applications using python programming.
CO7: Develop and use Web Services using python.

Course Contents:

Unit I

Introduction to Python Language, Strengths and Weaknesses, Installing IDLE, Dynamic Types, Naming Conventions, String Values, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Built In Functions

Unit II

Geometric Modeling:Introduction to 2D, 2 1/2 and 3D modeling,Types – Wireframe modeling, surface modeling and solid modeling.

Wireframe Modeling: Wireframe entities and its types, Analytic and synthetic entities, representation of wireframe entities- parametric and non-parametric and its benefits, advantages and limitations of wireframe modeling

Curves: Analytic and synthetic curves, Degree of the curves, Interpolation and Approximation Curves, control of curves (Local and Global), Continuity of Curves, parametric representation of the synthetic curves and its advantages, Hermite cubic spline, Bezier curve and B-spline curve (only equation) and their properties, curve manipulations.

Unit III

Surface Modeling: Introduction, surface entities, parametric representation of surfaces, analytic surfaces - plane surface, ruled surface, surface of revolution, tabulated cylinder. Synthetic surfaces - Hermite bi-cubic surface, Bezier surface, B-spline surface. Introduction about Coons Patch, benefits of surface modeling, surface manipulations.

Unit IV

Solid Modeling: Introduction and need, geometry and topology, solid modeling techniques – Boundary Representation (B-Rep), Constructive Solid Geometry (CSG), Sweep with their advantages and limitations, Advantages of solid modeling.

Suggested Books:

1. Ibrahim Zeid and R. Sivasubramaniam, 2nd Edition, CAD/CAM – Theory and Practice, Tata McGraw Hill, India, 2009

2. M. Groover and E. Zimmers, CAD/CAM: Computer Aided Design and Manufacturing, Pearson Education, 2007

3. Chennakesava R. Alavala, "CAD/CAM: Concepts and Applications", PHI Learning Pvt. Ltd.

Suggested Readings:

1. P. N. Rao, CAD/CAM – Principles and Applications, Tata McGraw Hill, India.

Dr. Miltiadis A. Boboulos

2. CAD-CAM & Rapid prototyping Application Evaluation,

3. James A. Rehg, Henry W. Kraebber, "Computer Integrated Manufacturing", Pearson Education. 2007

Web links:

1.https://pdfs.semanticscholar.org/presentation/2652/67ca6ed0b52d8601d024e36f9713bf1d7745.pdf

2.https://dce.kar.nic.in/new%20files/Chapter4-9-07.pdf

3.http://nptel.ac.in/courses/107103012/module8/lec1.pdf

4.http://www2.ensc.sfu.ca/~gwa5/index_files/25.353/indexf_files/9Geometricmodel-a-06.pdf

5.https://www.ics.uci.edu/~majumder/VC/new-lectures/geom.pdf

BMA302: COMPUTER AIDED DESIGN – I

Credits : 3

LTP 300

Course Description: The aim of this course is to acquaint the students with the knowledge of useability of computers in the product lifecycle of any product along with dedicated CAD/CAM software and hardware. This course also includes Geometric Modeling – Wireframe modeling, Surface Modeling and Solid Modeling.

Course Outcomes (CO): Students will be able

After the completion of this course:

1. The students would be able to describe the Product Development Cycle for any product under design.
2. The students will be able to suggest the Hardware and Software requirements for any graphics package.
3. The student will be able to generate and design the various curves used for generating the Wireframe Models.
4. The student will be able to generate the various surfaces and solid models using different surface entities and Solid Modeling Techniques.

Course Contents:

Unit I

Introduction: Product Development Cycle, introduction to CAD/CAM, concept of a workstation, advantages of CAD/CAM.

Graphics Hardware: Input/output devices, Random and Raster Scan Technologies, memory, graphic cards, networking and networking architectures.

CAD Software: Software Modules – Operating System, Applications System, Modelling and Viewing, Co-ordinate Systems – World Coordinate System, Working (User) Coordinate System, Screen Coordinate System, Basic Definitions – Data Structure, Database, DBMS, Database, Modes of Operations, User Interface.

Unit II

Geometric Modeling: Introduction to 2D, 2 1/2 and 3D modeling, Types – Wireframe modeling, surface modeling and solid modeling.

Wireframe Modeling: Wireframe entities and its types, Analytic and synthetic entities, representation of wireframe entities- parametric and non-parametric and its benefits, advantages and limitations of wireframe modeling

Curves: Analytic and synthetic curves, Degree of the curves, Interpolation and Approximation Curves, control of curves (Local and Global), Continuity of Curves, parametric representation of the synthetic curves and its advantages, Hermite cubic spline, Bezier curve and B-spline curve (only equation) and their properties, curve manipulations.

Unit III

Surface Modeling: Introduction, surface entities, parametric representation of surfaces, analytic surfaces - plane surface, ruled surface, surface of revolution, tabulated cylinder. Synthetic surfaces - Hermite bi-cubic surface, Bezier surface, B-spline surface. Introduction about Coons Patch, benefits of surface modeling, surface manipulations.

Unit IV

Solid Modeling: Introduction and need, geometry and topology, solid modeling techniques – Boundary Representation (B-Rep), Constructive Solid Geometry (CSG), Sweep with their advantages and limitations, Advantages of solid modeling.

Suggested Books:

1. Ibrahim Zeid and R. Sivasubramaniam, 2nd Edition, CAD/CAM – Theory and Practice, Tata McGraw Hill, India, 2009
2. M. Groover and E. Zimmers, CAD/CAM: Computer Aided Design and Manufacturing, Pearson Education, 2007
3. Chennakesava R. Alavala, "CAD/CAM: Concepts and Applications", PHI Learning Pvt. Ltd.

Suggested Readings:

1. P. N. Rao, CAD/CAM – Principles and Applications, Tata McGraw Hill, India.
Dr. Miltiadis A. Boboulos
2. CAD-CAM & Rapid prototyping Application Evaluation,
3. James A. Rehg, Henry W. Kraebber, "Computer Integrated Manufacturing", Pearson Education. 2007

Web links:

1.https://pdfs.semanticscholar.org/presentation/2652/67ca6ed0b52d8601d024e36f9713bf1d7745.pdf

2.https://dce.kar.nic.in/new%20files/Chapter4-9-07.pdf

3.http://nptel.ac.in/courses/107103012/module8/lec1.pdf

4.http://www2.ensc.sfu.ca/~gwa5/index_files/25.353/indexf_files/9Geometricmodel-a-06.pdf

5.https://www.ics.uci.edu/~majumder/VC/new-lectures/geom.pdf

BMA303: STRENGTH OF MATERIAL

Credits : 4

LTP 310

Course Description: The aim of this course is to enabling the student to understand & analyze various types of loads, stresses & strains along with main causes of failure of machine parts. The course includes simple stress and strains, Moment of Inertia. Shear force and bending moment, Strain energy and impact loading and Torsion of circular shaft.

Course Outcomes (CO): Students will be able

1. Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
2. Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
3. Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.
4. To apply advanced knowledge of components in terms of principles of strength of materials.

Unit I

Simple stresses and strains: Concept of stress and strain: St. Venants principle of stress and strain diagram, Hooke's law, Young's modulus, Poisson ratio, stress at a point, stresses and strains in bars subjected to axial loading, modulus of elasticity, stress produced in compound subjected to axial loading, temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound walls.

Compound stresses and strains: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications, two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain, relationship between elastic constants.

Unit II

Bending moment and shear force diagrams: Bending moment and shear force diagrams, SF and BM definitions, BM and SF diagrams for cantilevers, simply supported and fixed beams

with or without overhangs and calculation of maximum BM and SF and the point of contra-flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Unit III

Theory of bending stresses: Assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel sections, composite/flitched beams, bending and shear stresses in composite beams, unsymmetrical bending, combined bending and torsion, bending and axial loads etc.

Unit IV

Torsion: Derivation of torsion equation and its assumptions, applications of the equation of the hollow and solid circular shafts, torsional rigidity, combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Thin cylinders and spheres: Derivation of formulae and calculations of hoop stress longitudinal stress in a cylinder and sphere subjected to internal pressures increase in diameter and volume.

Columns and Struts: Columns under uni-axial load, buckling of columns, slenderness ratio and conditions, derivations of Euler's formula for elastic buckling load, equivalent length, Rankine Gordon's empirical formula.

Text Books:

1. Strength of Materials by R.S Lehri and A.S. Lehri, (S.K Kataria and Sons.)
2. Strength of Materials by Dr.Sadhu Singh (Khanna Publishers)
3. Strength of Materials by R.S Khurmi (S.Chand& Co.)
4. Strength of Materials by Dr.D.SBedi; (S Chand Publishers)

Suggested Readings:

1. Mechanics of Materials-SI Version 2nd Edition by EP Popov, (Prentice Hall India)
2. Introduction to Solid Mechanics by D.H Shames, (Prentice Hall Inc.)
3. Mechanics of Materials by Pytel
4. Strength of Materials by Ryder
5. Strength of Materials by Timoshenko and &Young

Web Links:

1.https://www.pdfdrive.net/strength-of-material-by-r-k-bansal-e22366752.html
2.http://nptel.ac.in/Aeronautical/Strength%20of%20Materials/course_strength%20of%20materials.pdf
3.http://www.mechanicalgeek.com/rk-bansal-strength-of-materials-pdf-download/
4.https://www.slideshare.net/MohammedMubeen1/some-basics-of-strength-of-materials
5.http://engr.bd.psu.edu/rxm61/213/CH1_Intro&Statics.ppt
6.https://www.technicalsymposium.com/Auto_Sem5_ME2303NOL.ppt

BEE321: ELECTRONIC DEVICES

Credits : 3

LTP 300

Course Description: The course aims to equip the students with principle of operation, analysis and design of junction diode, BJT and FET transistors and amplifier circuits. Also student apply concepts for the design of ICs, FETs and BJTs. The course includes Integrated circuit fabrication processes, details of semiconductor physics. BJT and FETs and their applications.

Course Outcomes (CO):

Upon Successful completion of the course, student should be able to:

CO1: Understand the principles of semiconductor materials.

CO2: Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

CO3: Analyze and design diode application circuits, amplifier circuits and oscillators employing BJT, FET devices.

CO4: Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation and evaluate frequency response to understand behavior of Electronics circuits.

Course Content

Unit I

Semiconductor Basics: Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Electrons and Holes, Intrinsic and Extrinsic materials, Carrier transport: diffusion current, drift current, Generation and recombination of carriers; Conductivity and Mobility, Effects of temperature and doping on mobility, Hall Effect, P-N junction diodes, I V characteristics; Rectification – Half-wave – Full-wave and Bridge, Filters- types- capacitor filter, choke input filter, capacitor input filter. Zener Diodes -Shunt voltage regulator, Varactor Diodes – Schottky Diodes – Tunnel Diodes , PIN diodes and LEDs.

Unit II

Bipolar Junction Transistor: Transistor current components, Transistor as an amplifier, Amplifier types CE, CB, CC and their characteristics, small signal low frequency transistor model: Hybrid model of BJT and its analysis, Transistor at high frequency and hybrid pi Model, introduction to HBT.

Unit III

Field Effect Transistor: The junction FET construction, operation, characteristics, parameters, Biasing of JFET, Small signal analysis of JFET as an amplifier common source and common drain amplifiers, Introduction to MOSFET: MOSFET construction, operation, characteristics, parameters CMOS devices, CMOS inverter characteristics, metal semiconductor.

Unit IV

Integrated Circuit fabrication process: Oxidation, Diffusion, Ion Implantation, Photolithography, etching, Chemical vapor deposition.

Recommended Books/ Suggested Readings:

1.Millman, Jacob, Halkias Christos C and Satyabratajit, “Electronic Devices and Circuits 3rd edition, Tata McGrawHill, New Delhi,2010.

2.Sedra, Adel S and Smith, Kenneth C, “Microelectronic Circuits” 4Th edition Oxford University Press,New York,1997

3.Floyd, Thomas L, “Electronic Devices” 6th edition, Pearson Education, 2002

4.Streetman Ben J, Sanjay Banerjee, “Solid State Electronic Devices” 5th edition, PHI, 2004.

5.Millman and C.C. Halkias: Electronic devices and Circuits, McGraw Hill, 1976.

6.Adir Bar-Lev: Semiconductors and Electronic Devices, (3/e), Prentice Hall, 1993.

7.B.G. Streetman, S.K. Banerjee: Solid state Electronic devices, (6/e), PHI, 2010.

8.https://electronicsforu.com/resources/electronic-devices-and-circuit-theory

9.https://www.elsevier.com/books/electronic-devices-and-circuits/pridham/978-0-08-203407-0

http://nptel.ac.in/courses/122106025/2

BCS 222: BASICS OF PYTHON LABORATORY

Credits : 1

LTP 002

Course Description: The Python programming language which is one of the most popular programming languages worldwide. The course shows you how to use the free open-source Python to write basic programs and Python, functions, variables, If Else statements, For loops, While loops, iterative and recursive programs and algorithms such as the Insertion Sort algorithm.

Course Outcomes (CO): Students will be able

Upon successful completion of the course, the students should be able to:

CO1: Apply the principles python programming.

CO2: Write clear and effective python code.

CO3: Create applications using python programming.

CO4: Develop and use Web Services using python.

List of Experiments

1. Write python program to print Hello World
2. Write python program to Hello World using string variable
3. Write python program to store data in list and then try to print them.
4. Write python program to do basic trim and slice on string.
5. Write python program to print list of numbers using range and for loop
6. Write python program to store strings in list and then print them.
7 Write python program to let user enter some data in string and then verify data and print welcome to user.
8 Write python program in which a function is defined and calling that function prints Hello World
9 Write python program in which a function (with single string parameter) is defined and calling that function prints the string parameters given to function.
10 Write python program in which a class is define, then create object of that class and call simple print function define in class.

BMA322: COMPUTER AIDED DESIGN – I LABORATORY

Credits : 2

LTP 004

Course Description: This course aims to equip the students with the practical aspects of the Computer Aided Design (CAD) by making the students to work on any of the CAD application software like Creo/Catia/NX-CAD etc. It involves the practicing on creating sketches and solid models of any product.

Course Outcomes (CO):

After the competition of this course:

1. The students will be able to identify and suggest the hardware and software requirements of a CAD application software.
2. Apply sketching constraints on digital 2D drawings.
3. Generate 3D models using solid modeling CAD tools.
4. Indent different materials and calculate mass properties of parts.

Course Contents:

Basic Concepts: Basic fundamentals of computer hardware and software, discussion about parametric concept, fundamentals of application software, discussion and advantages about CAD/CAM technology.

2D Sketching: Basic of sketching, practice on sketching profile (line, circle, rectangle, arc, spline etc.), practice on editing tool (fillet, chamfer, delete segment, corner, modify), discussion about constraining concepts, discussion about different types of constraints, various dimensioning methods: absolute dimensioning, incremental dimensioning, linear, radial, diameter, angular, slanted dimensions.

Solid Modeling: Discussion about solid modelling, advantage of solid modeling, discussion about finding mass properties, density, volume, density of different engineering materials, various tools used in solid modelling: Extrude, revolve tool, modification tools: Round, chamfer, various types of datum features, rib tool, advantage of draft tool, advantage of shell tool, mirror tool, copy & paste special tool, hole, pattern tool, sweep, blend, swept blend, variable section sweep, helical sweep, product development with Conceptual Design, solidify

tool with its advantages, section tool with its types.

List of Practicals:

1. Create a wireframe in Sketcher for various given exercises.
2. To constrain a wireframe in Sketcher for various given exercises.
3. Editing and modify the geometries for various given exercises.
4. To convert a 2D sketch into 3D object with help of Part modeling tools for the given exercises.
5. To modify the 3D part model with the help of Dress-up features.

BMA323: STRENGTH OF MATERIAL LABORATORY

Credits : 1

LTP 002

Course Description: The course aims to equip the students with the experience of material testing procedures. The course includes measuring strength, hardness, toughness and stresses of material.

Course Outcomes (CO): Students will be able

At the end of the course, the student will be able to:

1. To perform the tensile and compressive test and be able to determine the ultimate tensile and compressive stress respectively.
2. To perform the torsional test and determine the modulus rigidity and stiffness.
3. Determine the Brinell's and Rockwell hardness number of the given specimen.
4. Determine the Toughness of the material using CHARPY and IZOD Test.

List of experiments:

5. Draw Stress Strain curve for Ductile and Brittle material in tension.
6. Draw Stress Strain curve for Ductile and Brittle material in compression.
7. Draw shear stress, shear strain curve for ductile and brittle material in torsion strength testing.
8. Draw load deflection curve for spring in loading and unloading conditions.
9. To determine the hardness of the given material by Rockwell and Brinell hardness testing machine.
10. To determine the fatigue strength of the material.
11. To determine the impact strength by Izod and Charpy test.

BEE321: ELECTRONIC DEVICES LABORATORY

Credits : 1

LTP 002

Course Description: The course aims to equip the students with the study of basic electronic components and to observe characteristics of electronic devices. The course includes design and test rectifiers with filters, construct and test amplifier circuits and interpret the results.

Course Outcomes (CO):

At the end of the course the students can able to

CO1: Measure voltage, frequency and phase of any waveform using CRO.

CO2: Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.

CO3: Analyze the characteristics of different electronic devices such as diodes, transistor amplifier etc.

Course Contents:

List of Experiments:

1. To observe the V I characteristics of P-N junction diode.
2. To observe the V I characteristics of Zener diode.
3. To measure the value of BJT transistor as an amplifier.
4. To operate the CRO with function Generator (sine, square, triangular waveform).
5. To verify the I/O characteristics of CE amplifier.
6. To verify the I/O characteristics of CC amplifier.
7. To measure the gain of Transformer couple amplifier.
8. To observe the response of FET transistor amplifier.
9. To observe the response of MOSFET transistor.
10. To verify the working of a Half wave rectifier, Full wave rectifier and full wave bridge rectifier and to measure the ripple factor.

BEE402: Analog Circuits

Credits : 3

LTP 300

Course Description: The course aims to equip the students with the analysis and design of basic transistor amplifier circuits and their frequency response characteristics, feedback amplifiers, oscillators, large signal amplifiers and tuned amplifiers. Student are also demonstrated and analyze basic amplifier operation and amplifier circuits using hybrid models. The course includes study of differential amplifier, large signal amplifiers, single stage amplifiers, BJT, FET, JFET amplifiers, Oscillators, tuned amplifiers and feedback amplifiers.

Course Outcomes (CO): Students will be able

CO1: Design and analyze the DC bias circuitry of BJT and FET.

CO2: Analyze the different types of amplifiers, operation and its characteristics.

CO3: Design circuits like amplifiers, oscillators using the transistors diodes and oscillators.

CO4: Understand the functioning of OP-AMP and design OP-AMP based circuits.

Unit I

SINGLE STAGE AMPLIFIERS: Classification of amplifiers, Analysis of a transistorCE,CB&CCamplifiercircuitusingsimplifiedhparameters,AnalysisofCEamplifierwithemitterresistanceand emitter follower. Design of single stage RC coupled amplifier using BJT ; Multistage

Amplifiers: Distortioninamplifiers,AnalysisofcascadedRCcoupledBJTamplifier,cascodeamplifier,Darlingtonpair,CouplingschemesRCcoupledamplifier,transformercoupledamplifier,DirectcoupledAmplifier,multistageamplifierusingJFET. Transistor hybrid –pi model, Logarithms, Decibels, general frequency considerations, Frequencyresponse of an amplifier.

Unit II

FEEDBACKAMPLIFIERS:ConceptofFeedbackandtypes,transfergainwithfeedback,generalcharacteristics of negative feedback amplifiers, Effect of negative feedback on amplifiers characteristics,voltageseries,currentseries,currentshunt,andvoltage shuntfeedbackamplifiers.

OSCILLATORS: Classification of oscillators, Constituents of an oscillator, Barkhausen criterion, RC phaseshiftoscillator,Wein-bridgeoscillator,GeneralizedanalysisofLCoscillators-

HartleyandColpittsoscillator,Crystaloscillator,Stabilityofoscillator,UJTrelaxationoscillator.

Unit III

LARGE SIGNAL AMPLIFIERS: Classification , Distortion in amplifiers, class A large signal amplifiers,transformer coupled class A power amplifier, efficiency of class A amplifier, class B power amplifier,efficiency of class B amplifier, class B push pull amplifier, Complementary symmetry class B push pullamplifiers,classABpushpullamplifier,classCamplifiers,classDamplifier,thermalstability,heatsink.

TUNEDAMPLIFIERS: Introduction,classificationoftunedamplifiers,smallsignaltunedamplifier, Effectofcascadingsingletunedamplifieronbandwidth, Effect ofcascadingDoubletunedamplifieronbandwidth,Staggeredtunedamplifier,stabilityofTuned Amplifier.

Unit IV

Differential Amplifier: Basic structure and Principle of operation, common mode gain and CMRR. OP-AMP Design: design of differential amplifier for a given specification. OP-AMP applications: Inverting and Non-Inverting Amplifiers, Integrator and Differentiator, summing amplifier.

Recommended Books/ Suggested Readings:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11 Publishing, Edition IV.
5. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition.
6. J.D. Ryder : Networks, Lines and Fields, PHI.
7. D.M. Pozar, Microwave Engineering (3/e) Wiley,2004.
8. http://www.analog.com/en/education/education-library/tutorials/analog-electronics.html
9. https://onlinecourses.nptel.ac.in/noc18_ee19/preview
10. https://onlinecourses.nptel.ac.in/noc18_ee11/preview
11. https://www.youtube.com/watch?v=2bprLH4cUSo
12. https://lecturenotes.in/subject/7/analog-electronic-circuits-aec

BEE403: Control System Engineering

Credits : 3

LTP 300

Course Description: The course aims to equip the students with the concepts related to the operation analysis and stabilization of control systems. Student also understand the compensation technique that can be used to stabilize control systems. The course includes the open loop and closed loop (feedback) systems, time domain and frequency domain analysis of control systems required for stability analysis.

Course Outcomes:

CO1: A thorough knowledge on open loop and closed loop control systems, concept of feedback in control systems.

CO2: Transfer function representation through block diagram algebra and signal flow graphs.

CO3: Time response analysis of different ordered systems through their characteristic equation.

CO4: Time domain specifications, stability analysis of control systems in s-domain through R-H
criteria.

CO5: Root locus techniques, frequency response analysis through Bode diagrams, Nyquist, Polar plots.

Course Contents:

Unit I

Control System Modeling: Basic Elements of Control System – Open loop and Closed loop systems – Differential equation – Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems – Block diagram reduction Techniques – Signal flow graph

Unit II

Time Response Analysis: Time response analysis – First Order Systems – Impulse and Step Response analysis of second order systems – Steady state errors – P, PI, PD and PID Compensation.

Unit III

Stability Analysis: Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram – Nyquist Stability Criterion – Relative Stability

Unit IV

Frequency Response Analysis: Frequency Response – Bode Plot, Polar Plot, Nyquist Plot – Frequency Domain specifications from the plots – Constant M and N Circles – Nichol's Chart – Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators – Lead, Lag, and Lead Lag Compensators.

Unit V

State Variable Analysis & Digital Control Systems: State space representation of Continuous time systems- state equations – transfer function from state variable representation- Solutions of the state equations- concepts of controllability and observability. State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sample &o Hold – Open loop & Closed loop sampled data systems.

Recommended Books/ Suggested Readings:

1. J. Nagrath, M. Gopal,Control Systems Engineering,New Age Publication(4/e), 2010.
2. A. Ramakalyan, Control Engineering, Vikas, 2003.
3. R.C. Dorf & R.H. Bishop, Modern Control Systems (8/e), Pearson, 1999.
4. K. Ogata : Modern Control Engineering, (3/e), PHI, 1998.
5. B.C. Kuo : Automatic Control Systems, (7/e), PHI, 1997.
6. K. Morris : An Introduction to Feedback Control, Academic Press, 2001.
7.https://lecturenotes.in/subject/52/control-system-engineering-cse
8.http://nptel.ac.in/courses/108101037/

BEE305: DIGITAL ELECTRONICS AND APPLICATIONS

Credits : 3

LTP 300

Course Description: The course aims to equip the students with the basic postulates of Boolean algebra and shows the correlation between Boolean expressions. Also simplify the methods for Boolean expressions. The course includes the formal procedures for the analysis and design of combinational and sequential circuits. The concept of memories and programmable logic devices, their classifications and it also include the number representation & conversion between different representations in digital electronics circuits.

Course Outcomes:

CO1: Develop a digital logic and apply it to solve real life problems.

CO2: Design and implement Combinational and Sequential circuits.

CO3: Design and implement Synchronous and Asynchronous Sequential Circuits.

CO4: Analyze different methods used for simplification of Boolean expressions.

Course Contents:

Unit I

Number Systems and Boolean Algebra: Number systems, Binary addition and Subtraction, Subtraction using 1's & 2's complements and using 9's &10'scomplements, Binary codes, Error detecting and Correcting codes, Theorems of Boolean algebra, Canonical forms, Logic gates, Representation of logic functions, Simplification using Karnaugh map, Tabulation method.

Unit II

Combinational Circuits: Representation of logic functions, Simplification using Karnaugh map, Tabulation method, Implementation of combinational logic using standard logic gates, Multiplexers and DE multiplexers, Encoders and Decoders, Code Converters, Adders, Subtractors, Parity Checker and Magnitude Comparator.

Unit III

Sequential Circuits: Flip flops SR, JK, D and T flip flops Level triggering and edge triggering, Excitation tables. Counters -Asynchronous and synchronous type modulo counters, design with state equation state diagram, Shift registers, type of registers, circuit diagrams. D/A And A/D Converters: Weighted resistor type D/A Converter, Binary ladder D/A converter, D/A accuracy and resolution. Successive approximation A/D converter, Single and Dual slope A/D converter, A/D accuracy and resolution.

Unit IV

Digital Logic Families and Semiconductor memories: Introduction to bipolar Logic families: RTL, DCTL, DTL, TTL, ECL and MOS Logic families: NMOS, PMOS, CMOS, Details of TTL logic family. Memory organization, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories, Charged-Coupled Device memory. Digital System design Principles: Development and basic principles of Integrated chip fabrication, advantages of chip fabrication, PLA, PAL and FPGA.

Recommended Books/ Suggested Readings:

1. Wakerly J F, Digital Design: Principles and Practices, Prentice-Hall, 2nd Ed., 20022.
2. D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2003.
3. S. Brown and Z. Vranesic, Fundamentals of Digital Logic with Verilog Design, Tata Mc-Graw Hill, 2008.
4. D.P. Leach, A. P. Malvino, GoutamGuha, Digital Principles and Applications, Tata Mc-Graw Hill, New Delhi, 2011.
5. M. M. Mano, Digital Design, 3rd ed., Pearson Education, Delhi, 2003.
6. R.J. Tocci and N.S. Widner, Digital Systems - Principles& Applications, PHI, 10th Ed., 2007.
7. Roth C.H., Fundamentals of Logic Design, Jaico Publishers. V Ed., 2009.
8. T. L. Floyd and Jain, Digital Fundamentals, 8th ed., Pearson Education, 2003.
9. https://onlinecourses.nptel.ac.in/noc18_ee33/preview
10. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
11. https://www.electrical4u.com/electrical-engineering-articles/digital-electronics/

BMA403: COMPUTER AIDED DESIGN - II

Credits : 3

LTP 300

Course Description: This course aims to impart the knowledge of computer graphics like Geometric transformations, projections involved in CAD and CAM. It also impart the students with the introductory knowledge of Finite Element Analysis and the various data exchange formats used to transfer CAD/CAM data. This course also includes the understanding of the techniques like Group Technology, Computer Aided Process Planning, FMS and CIMS.

Course Outcomes (CO):

1. Upon the completion of this course the student should be able to modify the curves, surfaces and solids by using various geometric transformations in any CAD/CAM softwaresThe student will be able to generate the orthographic and isometric projections of any CAD model.
2. The student will be able to perform the simple analysis using FEM, calculate the geometric and mass properties for analysis. The students would be able to convert the CAD files from native database to neutral database for the ease of CAD data exchange.
3. The student will be able to make the part families for the Group Technology used in manufacturing and to produce the process plan for simple mechanical parts.
4. The student will be able to implement the concept of Flexible manufacturing system and computer integrated manufacturing system in any manufacturing system.

Course Contents:

Unit I

Geometric Transformations: World/device coordinate representations, matrix representation, 2D and 3D geometric transformations - translation, scaling, shearing, rotation and reflection, homogeneous co-ordinates, concatenated transformations.

Projections: Orthographic, Isometric, Perspective, Point at Infinity & Vanishing Point.

Unit II

Finite Element Method: Basic introduction, finite element procedure, finite element analysis, element shapes and nodes

Data Exchange: Introduction and need of data exchange, graphics standard, GKS, data exchange formats – IGES, STEP, DXF.

Geometric and Mass Property Calculations: Geometric Properties - Curve Length, cross-sectional area, surface area, volume calculation, Mass Properties – Mass, centroid, first moment of inertia, second moments.

Unit III

Group Technology: Introduction to part families, parts classification and coding techniques (Opitz Coding System), group technology machine cells, benefits of group technology.

Computer Aided Process Planning: Process Planning, CAPP & types of CAPP, advantages of CAPP.

Unit IV

Flexible manufacturing systems: FMS concept, components of FMS, types of flexibilities, FMS layouts,

Computer Integrated Manufacturing Systems: CIM wheel, CIM Database, CIM, Networking Standards in CIM environment.

Suggested Books:

1. Ibrahim Zeid and R. Sivasubramaniam, 2nd Edition, CAD/CAM – Theory and Practice, Tata McGraw Hill, India, 2009
2. M. Groover and E. Zimmers, CAD/CAM: Computer Aided Design and Manufacturing, Pearson Education, 2007
3. James A. Rehg, Henry W. Kraebber, “Computer Integrated Manufacturing”, Pearson Education. 2007
4. Chennakesava R. Alavala, “CAD/CAM: Concepts and Applications”, PHI Learning Pvt. Ltd.

Suggested Readings:

1. P. N. Rao, CAD/CAM – Principles and Applications, Tata McGraw Hill, India.
Dr. Miltiadis A. Boboulos
2. CAD-CAM & Rapid prototyping Application Evaluation,
3. James A. Rehg, Henry W. Kraebber, “Computer Integrated Manufacturing”, Pearson Education. 2007

Web Links:

1.http://nptel.ac.in/courses/112102101/3

2.http://vr.me.ncku.edu.tw/courses/cg99/Download/CG12.pdf

3.http://www.fkm.utm.my/~kasim/eng_design/vr/Lecture12-file.format.pdf

4.https://pdfs.semanticscholar.org/presentation/f8af/cb0e83fb06130e375512f5521b872bb304ba.pdf

5.https://users.soe.ucsc.edu/~pang/160/f12/slides/dda2.pdf

BMA404: KINEMATICS AND DYNAMICS OF MACHINES

Credits : 4

LTP 310

Course Description: The course aims to equip the students with knowledge of basic mechanism and machine. The course includes basic principle of mechanism and their inversion, Power Transmission, flywheel and governor etc.

Course Outcomes:

1. To draw velocity and acceleration diagrams for various mechanisms.
2. To recommend various types of belts, chains, rope drives and cam for power transmission.
3. To identify the parameters involved in the working and application of flywheel and Governors.
4. Apply the concepts of power transmission by the application of friction and reduce thetransmission losses using gear drives.

Course Contents:

Unit I

Basic concept of machines and mechanisms: Link, mechanism, kinematic pair and chain, principles of inversion, inversion of a four bar chain, slider- crank-chain, double slider crank chain and their inversions, kinematic pairs and analytical geometrical methods for finding displacement velocity and acceleration of all basic mechanisms.

Unit II

Belts, Ropes and chains: Material types of drives, idler pulley, intermediate or counter shaft pulley, angle drive and quarter turn drive, velocity ratio, crowning of pulleys, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sides of belts, HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted, flat, V-belts and rope materials, length of belt, rope and chain drives.

Cams: Types of cams and followers, definitions of terms connected with cams, displacement, velocity and acceleration diagrams for cam followers, various motions: SHM, uniform acceleration and retardation, analysis of follower motion for circular, concave, tangent cam profiles.

Unit III

Flywheels: Turning moment and crank effort diagrams for reciprocating machines fluctuation of speed, coefficient of fluctuation of speed and energy, determination of flywheel effect.

Governors: Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson- Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction.

Unit IV

Gears & Gear Trains: Toothed gears and spur gears, types of toothed gears, definitions: pitch circle diameter, pitch surface, pitch point, circular pitch, module, pitch, diametrical pitch, addendum, dedendum, clearance, outside and internal diameters, root diameter, base circle diameter, face and flank of tooth, pressure angle, path of contact, arc of contact, conditions for correct gearing, forms of teeth, involute and its variants, interference and methods of its removal, types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel, helical and spiral gears.

Text Books:

1. Theory of Machines by R.S.Khurmi, (S.Chand and Sons)
2. Theory of Machines by S.S Ratan (McGraw Hill)
3. Theory of Mechanism and Machines by JagdishLal (Metropolitan Publication)

Suggested Readings:

1. Theory of Machines by Shigley, (McGraw Hill)
2. Theory of Machines by Thomas Bevan (PearsonsPublishiers)
3. Theory of Machines by PL Ballaney, (Khanna Publisher)

BEE422: Analog Circuits Laboratory

Credits : 4

LTP 310

Course Description: The course aims to equip the students with practical experience in design, assembly, testing and evaluation of Rectifiers and Voltage Regulators. The course includes BJT characteristics, JFET Characteristics, MOSFET Characteristics, RC-Phase shift, Hartley, Colpitts and Crystal Oscillators and Power Amplifiers.

Course Outcomes:

Upon completion of the subject, students will be able to:

CO1: Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.

CO2: Develop the ability to analyze and design analog electronic circuits using discrete components.

CO3: Observe the amplitude and frequency responses of common amplification circuits.

CO4: Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

Course Content

List of Experiments:

1. Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier
2. To measure the gain of push-pull amplifier at 1KHz
3. To measure the voltage gain of emitter follower circuit and plot its frequency response
4. Plot the frequency response curve of Hartley and Colpitts Oscillator
5. Plot the frequency response curve of phase shift and Wein bridge Oscillator
6. To use IC 741 (op-amplifier) as i) Inverter, ii) Adder, iii) Subtracter iv) Integrator
7. To implement Notch filter using Op-Amp.
8. To verify Maxwell Inductance bridge
9. To implement Wein's bridge oscillator
10. To implement UJT as relaxation oscillator.

BEE423: Control System Engineering Laboratory

Credits : 1

LTP 002

Course Description: The course aims to equip the students with the fundamental concepts of control system such as mathematical modeling, time response and frequency response and also develop concepts of stability and its assessment criteria. The course includes the modelling, simulation, and implementation of a physical dynamical system by a linear time invariant ordinary differential equation, electrical modelling of a second order system and analyse the under-damped, over-damped and critically damped cases. Also the effects of poles and zeros location in the s-plane on the transient and steady state behaviour.

Course Outcomes (CO):

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

CO1: Develop the mathematical model of the physical systems.

CO2: Analyze the response of the closed and open loop systems.

CO3: Analyze the stability of the closed and open loop systems.

CO4: Design the various kinds of compensator.

CO5: Develop and analyze state space models.

Course Contents:

1. To study the Transient response of R-L and R-C Network
2. Teo study the Transient response of R-L-C series and parallel circuits.
3. To determine the Impedance (Z) and Admittance (Y) parameters of two port network: Simulation / hardware.
4. Ton study the Frequency response of LP and HP filters: Simulation / hardware
5. To study the Frequency response of BP and BR filters: simulation / hardware
6. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
7. Determination of Lap lace transform and Inverse Lap lace transform using MATLAB.
8. Amplitude and Phase spectrum analysis of different signals using MATLAB.
9. Verification of Network theorems.

BEE325: DIGITAL ELECTRONICS AND APPLICATIONS LABORATORY

Credits : 1

LTP 002

Course Description: The course aims to equip the student's knowledge with the laboratory course which enables to get practical experience in design, realization and verification of DE Morgan's Theorem, SOP, POS forms. The course includes Full/Parallel Adders, Subtractors, Magnitude Comparator, Multiplexer using logic gates, Demultiplexers, Decoders, Flip-Flops, Shift registers and Counters.

Course Outcomes:

Upon completion of the subject, students will be able to:

CO1: Demonstrate the truth table of various expressions and combinational circuits using logic gates.

CO2: Design, test and evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.

CO3: Construct flips-flops, counters and shift registers.

CO4: Simulate full adder and up/down counters.

Course Content

List of Experiments:

1. Design and verification of the truth tables of Half and Full adder circuits
2. Design and verification of the truth tables of Half and Full subtractor
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC7483
4. Design and implementation of code converters using logic gates

(i) BCD to excess-3 code

(ii) Binary to gray code

5. Verification of the truth table of the Multiplexer using IC 74150
6. Verification of the truth table of the De-Multiplexer using IC 74154
7. Design and test of an SR flip-flop using NOR/NAND gates
8. Verify the truth table of a D flip-flop (7474) and JK flip -flop (7476)
9. Verification of the results of 3-bit synchronous up/down counter
10. Verification of 4 bit ripple counter and Mod -10 / Mod-12 Ripple counters

11. Operate the universal shift register 74194

12. Operate a 7 segment LED display through a counter using a low frequency clock.

BMA423: COMPUTER AIDED DESIGN – II LABORATORY

Credits : 2

LTP 004

Course Description: This course is the extension of Computer Aided Design – I Laboratory that aims to equip the students with the Assembly and Drafting and detailing of the various solid models generated.

Course Outcomes (CO):

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

1. Create the assembly and sub-assembly of the complex parts in any of the CAD application software like Creo/Catia/NX-CAD.
2. Create BOM and BOM balloons, exploded views of any part/assembly.
3. Create the detailed drawings of the parts using the drafting techniques of any CAD application, to provide the detailing on the drawing like annotations, dimensioning.
4. Implement GD&T application in production/manufacturing design.

Course Contents:

Assembly: Discussion about assembly, advantages of assembly, types of joints, top up & bottom up assembly, understanding skeleton modeling, constraints used in assembly, creating and managing explode states, animating explode state, understanding and creating assembly cross-sections, setting display styles in assembly, discussion about mechanism, joints used for mechanism.

Drafting and Detailing: Assembly: discussion about drafting & detailing concepts, basic fundamentals of drawing, exploring drawing ribbon commands, creating drawings using formats & sheets, adding general views, adding projection views, editing drawing views by exploring its properties, editing visible view area, adding detail view, adding 2-d cross-section views, adding assembly exploded views, understandings annotations in drawings, showing, erasing and deleting annotations, adjusting dimensions and detail items, changing dimension display, understanding and configuring dimensional tolerances, understanding, configuring and applying geometric tolerances , adding and editing notes, applying surface finishing symbols, inserting tables, creating BOM table and BOM balloons, using layers in

drawings.

Flexible Modeling/Functional Part Design:

List of Practicals:

1. Preparation of 3D Assembly model using Creo Parametric software for Exercise - 1.
2. Preparation of 3D Assembly model using Creo Parametric software for Exercise - 2.
3. Preparation of 3D Assembly model using Creo Parametric software for Exercise - 3.

BMA434: KINEMATICS AND DYNAMICS OF MACHINES LABORATORY

Credits : 1

LTP 002

Course Description: The course aims to equip the students with practical knowledge of machine and mechanism.The course includes practical application of four bar mechanism and various inversion of kinematic chain.

Course Outcomes (CO):

1. Express a good understanding of the principles of mechanisms and machines, and their practical applications in Mechanical Engineering.
2. To study and evaluate the performance characteristic of cam, gear drive, governor and select the best suited drive for particular application.

List of Experiments:

1. To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.
2. To study the various inversions of kinematic chains.
3. To study inversions of 4 Bar Mechanisms, Single and Double slider crank mechanisms.
4. To study Steering Mechanisms: Davis and Ackerman.
5. To plot slider displacement, velocity and acceleration against crank rotation for Single Slider Crank mechanism.
6. To study the various types of governor.
7. To study various type of Cam and Follower arrangements.
8. To plot follower displacement vs Cam rotations for various Cam Follower systems.
9. To study various types of gears – Helical, worm & bevel gears.
10. To study various types of gear trains – simple, compound, reverted, epi-cyclic and differential.

BRE502: Electrical Machines and Power Systems

Credits : 3

LTP 300

Course Description: The course aims to equip the student's knowledge with the various types of electrical motors and drives along with their applications.

Course Outcomes (CO):

1. To analyze the construction and characteristics and application of D.C. motor.
2. To analyze the construction and characteristics and application of three phase induction motor.
3. To analyze the speed control methods of A.C. and D.C. motor.
4. To analyze the construction and characteristics and application of sensor, transducer and switches.
5. To analyze the industrial applications of electric drives.
6. To scrutinize three-phase transformer connections and use special purpose transformer for measurement and protection

Course Contents:

Unit I

Electromechanical Conversion and D.C. Machines: Electro-Mechanical Energy Conversion energy conversion in single and multiple excited systems. Constructional details – EMF equation, methods of excitation, self and separately excited generators, characteristics of series, and shunt generators, principle of operation of D.C. Motor, back EMF and torque equation, characteristics of series and shunt motors, starting of D.C. Motors, types of starters, speed control and braking of DC Motors.

Unit II

Transformers: Constructional Details, Principle of Operation, EMF Equation, Transformation Ratio, Transformer on No Load Parameters Referred To HV/LV Windings, Equivalent Circuit of Transformer on Load, Regulation, losses and Efficiency, Testing, Load Test , 3- PHASE Transformers and connections. Mutual and leakage fluxes, leakage reactance

Unit III

Induction Motors: Construction, types and principle of operation of three-phase induction motors – equivalent circuit – starting and speed control – single-phase induction motors (only qualitative analysis).

Synchronous And Special Machines: Construction of Synchronous machines types – induced EMF, brushless alternators, reluctance torque, reluctance motor, stepper motor servo motor., reluctance and hysteresis motors

Unit IV

Introduction to Power System: Structure of electric power systems – generation, transmission, sub-transmission and distribution systems – EHVAC, FACTS and HVDC transmission systems– substation layout.

Text Books:

1. K. Murugesh Kumar, 'Electric Machines Vo I', Vikas Publishing House Pvt Ltd, 2010.
2. K. Murugesh Kumar, 'Electric Machines Vol II', Vikas Publishing House Pvt Ltd, 2010
3. V.K.Mehta and Rohit Mehta, 'Principles of Power System', S.Chand and Company Ltd, 2003

Suggested Readings:

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.
2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002
3. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
4. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

BMA405: MANUFACTURING PROCESSES

Credits : 3

LTP 300

Course Description: To inculcate the principle, thermal and metallurgical aspects during solidification of metal and alloys and impart knowledge about welding behavior of machine and process during welding.To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving sound casting.

Course Outcomes (CO):

CO1: To analyze the thermal, metallurgical aspects during solidification in casting and welding and their role on quality of cast or weld objects.

CO2: To apply relevant theories to solve manufacturing problems

CO3: To design the gating and riser system needed for casting and requirements to achieve defect free casting.

CO4: To analyze the welding process behavior for common and newer welding techniques

CO5: To understand requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials

CO6: To improve a manufacturing process either working in a team or individually.

Course Contents:

Unit I

Moulding: Introduction to sand moulding, Pattern design, Pattern layout and construction, testing of moulding sand. moulding and core making machines, CO2 - Process, fluid sand process, shell moulding, cold curing process, hot-box method, flask less moulding, Design of metal moulds, Die Design for die Casting.

Unit II

Casting: Directional principles, Solidification, types of gating systems, Pouring time and temperature. Design criteria of pouring basin, sprue, runner, gate and riser, gating ratio-related numerical problems, Use of chaplet, chills and padding, Selection of melting furnaces, Crucible furnaces, Electric furnaces, Induction furnace, Control of melt and Cupola charge calculations. Foundry mechanization and layout.

Unit III

Welding: Principle, advantages, limitations and applications, Tungsten Inert Gas welding, Metal Inert Gas welding, Electro - slag welding, Electro - Gas Welding, Explosive Welding, Ultrasonic Welding, Electron Bean Welding, Laser Beam Welding, Friction Welding, Cold Welding, Thermit Welding. Welding Defects-causes and remedies.Numerical problems on electric arc welding and resistance welding.

Unit IV

Metal Forming: Introduction to Metal Forming, Elastic & plastic deformation, Hot working and cold working. Work required for forging, Hand, Power, Drop forging.Analysis of wire drawing and maximum reduction.Tube drawing, Extrusion, types and its application.Rolling process, rolling mills & rolled-sections.Defects in metal forming processes. Sheet metal processes, shearing, calculation of punch force, shearing dies, stretch forming, Deep drawing and its analysis.

Metal Cutting: Introduction to machining processes, classification, Mechanics of chip formation process, concept of shear angle, chip contraction and cutting forces in metal cutting, Merchant theory, tool wear, tool life, machinability. Numerical problems based on above mentioned topics, Fundamentals of measurement of cutting forces and chip tool interface temperature. Cutting tools: types, geometry of single point cutting tool, twist drill and milling cutter, tool signature.

Text Books:

1. Manufacturing processes Vol. 1, by H.S. Shan, Pearson Education
2. Manufacturing Engineering & Technology by Kalpakjian, Pearson Publication
3. Sharma P.C., “A Text Book of Production Engineering”, Vol.1, S. Chand Publication, New Delhi, 2001.

Suggested Readings:

1. Mikell P. Groover"Principles of Modern Manufacturing, 5th Edition SI Version , Wiley
2. Jain P.L., “Principles of Foundry Technology”, Tata McGraw Hill, New Delhi, 1998.
3. Heine & Rosenthal, “Principle of Metal Casting”, Tata McGraw Hills, New Delhi, 2003.
4. Little Richard L, “Welding & Welding Technology”, Tata McGraw Hill, New Delhi, 2003.
5. Jain, R.K., “Production Technology”, Khanna Publishers, 2001.

6. HMT Bangalore, “Production Technology”, Tata McGraw Hill, 1980.
7. A.K. Chakrabarti “Casting Technology and cast alloys” 2011, PHI learning

BRE601: Robot Kinematics and Dynamics

Credits : 3

LTP 300

Pre-Requisites: BRE501

Course Objectives:

1. To familiarize the students with the robot anatomy, links and joints.
2. To give knowledge about electrical and electronic controls used for robot.
3. To impart the knowledge of kinematics and dynamics of robots.

Course Outcomes:

After successful completion of the course the student will be able to:

1. Explain about the terminology that is used for therobots
2. Calculate the position of various joints of different robots for performing the differenttasks.
3. Calculate the velocity of differentjoints.
4. Design the trajectory for different tasks performed byrobots.

Course Contents:

Unit I

Introduction: Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics, Specifications of Robot-Speed of Robot, Robot joints and links, Robot classifications, Architecture of robotic systems, Robot Drive systems Hydraulic, Pneumatic and Electric system.

Unit II

End Effectors and Robot Controls: Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type Magnetic grippers, Vacuum grippers, Air operated grippers, Gripper force analysis, Gripper design.

Robot controls-Point to point control, Continuous path control, Sensors and Actuators - Strain gauge, resistive potentiometers, tactile and force sensors, tachometers, LVDT, piezoelectric accelerometer, Hall effect sensors, optical encoders, pneumatic and hydraulic actuators, servo valves, DC motor, stepper motor, drives.

Unit III

Direct & Inverse Kinematics: Dot and cross products, Co-ordinate frames, Rotations,

Homogeneous Coordinates, Link co- ordinates, Denavit-Hartenberg (D-H) Representation, Arm equation -Two axis, three axis, four axis, five axis and six axis robots. Inverse Kinematic problem, General properties of solutions, Tool configuration, Inverse Kinematics of Two axis Three axis, Four axis and Five axis robots. Articulated robot and four-axis SCARA Robot.

Static and Velocity Analysis: Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Statics of serial manipulators, work space analysis of serial link manipulators.

Trajectory and Motion Planning: Control joint and Cartesian space trajectory planning and generation, Joint-space schemes, Cartesian-space schemes, configuration space.

Unit IV

Robot Dynamics: Introduction to Euler-Langrangian and Newton-Euler formulations for serial robotic manipulators.

Robot Programming: On line programming, teach pendant control, Lead through programming, Walk through programming, off line programming, Task programming.

Text Books:

1. Schilling, R. J., Fundamentals of Robotics Analysis & Control, Prentice Hall ofIndia
2. S.R. Deb, Robotics and Flexible Automation, Tata mc GrawHill
3. Craig, J. J., Introduction to Robotics: Mechanics and Control, PearsonEducation
4. Deb, S. R., Robotics and Flexible Automation, McGrawHill
5. Saha, S. K., Introduction to Robotics, McGrawHill

Suggested Readings:

1. Fu, K. S., Gonzalez, R. C. and Lee, C. S., Robotics: Control, Sensing, Vision, and Intelligence, McGrawHill
2. Anthony Esposito, **Fluid Power with applications**,Pearson.
3. S.R. Majumdar, **Pneumatic Control**, Tata McGrawHill.

BMA507: INDUSTRIAL AUTOMATION

Credits : 3

LTP 300

Course Description: This course aims to equip the students with the knowledge of the fluid power control i.e. hydraulics and pneumatics and also with electrical and electronic controls used for robot. It also includes the automation and brief history of robot and applications.

Course Outcomes:

1. To recognize standard schematic symbols for common fluid power components.
2. To understand and troubleshoot basic fluid power, electro-hydraulic, and electro-pneumatic circuits using schematic diagrams.
3. To get the basic knowledge about the various transfer devices and feeders.
4. To know various different basic types of robots and how to program them.

Course Contents:

Unit I

Introduction: Concept and scope of automation, Socio economic consideration, Low cost automation.

Fluid Power Control: Fluid power control elements and standard graphical symbols, Construction andperformance of fluid power generators, Hydraulic and pneumatic cylinders – construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control: Servo valves and simple servo systems with mechanical feedback, governing differential equation and its solution for step position input, Basic hydraulic and pneumatic circuits.

Unit II

Pneumatic Logic Circuits: Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations

Fluidics: Boolean algebra, Truth tables, Coanda effect, Fluidic elements – their construction working and performance characteristics: Elementary fluidic circuits

Unit III

Transfer Devices and Feeders: Their Classification: Construction details and application of transfer devices and feeders (Vibratory bowl feeder, reciprocating tube feeder and

centrifugal hopper feeder).

Electrical and Electronic Controls: Introduction to electrical and electronic controls such as electromagnetic controllers – transducers and sensors, microprocessors, programmable logic controllers (PLC), Integration of mechanical systems with electrical, electronic and computer systems. ,

Unit IV

Robotics: Introduction, classification based on geometry, devices, control and path movement, End effectors – types and applications, Sensors – types and applications, Concept of Robotic/Machine vision, Teach pendent.

Industrial Applications of Robots for material transfer, machine loading / unloading, welding, assembly and spray painting operations.

Text Books:

1. A.K Gupta, S.K. Arora, I**ndustrial Automation and Robotics**, Laxmi Pubilaction (P) Ltd.
2. S.R. Majumdar, **Pneumatic Control,** Tata McGraw Hill.

Suggested Readings:

1. Anthony Esposito, **Fluid Power with applications,** Pearson.
2. S.R. Deb, **Robotics and Flexible Automation**, Tata mc Graw Hill

Web Links:

1.https://www.scribd.com/doc/237309451/Robotics-and-Industrial-Automation

2.http://nptel.ac.in/courses/108105063/pdf/L-01(SM)(IA&C)%20((EE)NPTEL).pdf

3.http://nptel.ac.in/downloads/112101098/

4.https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/

BMA506: METROLOGY AND QUALITY CONTROL

Credits : 3

LTP 300

Course Description: This course will facilitate students with the measuring instruments for different type of measurements and able to take decision regarding acceptance and rejection of the components.

Course Outcomes:

Upon successful completion of the course, the students should be able to:

1. Identify and select the relevant instrument for measurement.
2. Develop an ability of problem solving and decision making by identifying and analyzing the causefor variation and recommend suitable corrective actions for quality measurements using computer aided measurement techniques.
3. Describe various industrial metrological instruments for screw thread and gear profiles
4. Apply the fundamental principles for measurement of various mechanical quantities like force/torque and pressure etc.

Course Contents:

Unit I

General Concepts Need and classification of measurements and instruments; basic and auxiliary functional elements of a measurement system; Mechanical versus electrical / electronic instruments; primary, secondary and working standards.

Measuring and Gauging Instruments: Mechanical linear and angle measuring instruments, Vernier calipers, micrometers,dial gauges, bevel protectors, sine bars, spirit level, optical instruments autocollimator, tool room microscope. Comparators; principle, types of comparators, mechanical, optical, pneumatic, electrical comparators;

Unit II

Limits, fits and tolerances: Concepts of interchangeability, need for standards system of limits, fits and tolerances, BIS:919:1963 standard system, selection of limits and fits, exercise onlimits, fits and tolerances, design principles for limit gauges, Taylor's principles, types oflimit gauges, tolerances on limit gauges, Design of limit gauges.

Geometrical Metrology and Surface Finish: Concepts of form errors; straightness, flatness,

roundness errors and theirmeasurements usingcomputer aided measurement techniques, concept of micro and macro errors, measurement of surfaceroughness, stylus method using, mechanical, optical, electrical magnificationmethods.

Unit III

Screw Threads and Gear Metrology: Elements of screw threads metrology, measurement of major, minor and effectivediameters of external and internal screw threads, measurement of pitch and screwthread angle, Elements of gear metrology, measurement of gear tooth thickness,gear profile, pitch and runout for involute gears, gear rolling test;

Unit IV

Transducers: Transducers, types, governing principles of transducers; Examples. Displacementmeasurement, detailed study of various types of displacement transducers, Velocity measurement, linear and angular, study of velocity transducers;

Force, Torque and Pressure Measurement: Mechanical, pneumatic, and hydraulic load cells; torque measuring devices; dynamometers, types of strain gauges, factors affecting strain measurement; Electrical strain gauges, gauge material, fixing methods, strain gauge circuits, examples, use of strain gauges for the measurement of the force and torque, Pressure measurement, types of pressure transducer; differential pressure measuring devices, performance characteristics; low and high pressure measurement.

Text Books:

1. R.K. Jain, "Engineering Metrology ", S Chand and Company
2. D.S. Kumar, "Mechanical Measurement & Control", Metropolitan Publishers

Suggested Readings:

1. Doeblin, "Mechanical Measurement",Mcgraw Hill
2. Gharam T. smith, "Industrial Metrology" , Springer
3. I.C. Gupta, "Engineering metrology", Dhanpat Rai& sons delhi

Web Links:

1.https://www.slideshare.net/GopinathGuru3/metrology-53006927
2.http://nptel.ac.in/courses/112106179/
3.http://nptel.ac.in/courses/112106138/
4.http://home.iitk.ac.in/~jrkumar/download/Lecture-4.pdf

BRE522: Electrical Machines and Power Systems Laboratory

Credits : 1

LTP 002

List of experiments:

1. Draw the Open circuit characteristics of D.C. shunt generator.
2. Draw the Load characteristics of D.C. shunt generator.
3. Perform Load test on D.C. shunt motor.
4. Perform the Load test on D.C. series motor.
5. Perform Swinburne's test. On DC shunt motor
6. To control the speed of D.C. shunt motor.
7. Perform load test on single phase transformer
8. TO find the efficiency of single phase transformer by performing open circuit and short circuit tests on (Determination of equivalent circuit parameters).
9. Perform the Load test on single phase induction motor.
10. Perform the No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Perform Load test on Three phase induction motor.
12. To Study the different motor starters.

BMA435: MANUFACTURING PROCESSES LABORATORY

Credits : 1

LTP 002

Course Description: Introduction to the processes in which physical objects are manufactured. Topics include casting, machining, special treatment of steels, joining, welding, moulding of plastics forming of non-ferrous alloys.

Course Outcomes:

CO1: To prepare Mould preparation and demonstration Casting Process.

CO2: Understand the concept of gas, Arc, Spot, MIG, TIG welding and brazing process and fabricate joints using different welding processes.

CO3: Familiarize the students with the introduction of conventional machine tools like Lathe, Milling, Drilling etc.

CO4: Need for heating of the Mild Steel and to understand the Hot Working of the metals in Black Smithy.

Course Content

Casting:

1. To determine clay content, moisture content, hardness of a moulding sand sample.
2. To determine shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in green condition.
4. To determine permeability and grain fineness number of a moulding sand sample.

Welding:

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
2. To study MIG, TIG and Spot welding equipment and make weld joints by these processes.

Machining and Forming

1. To study constructional features of following machines through drawings/ sketches:

a. Grinding machines (Surface, Cylindrical)

b. Hydraulic Press

c. Draw Bench

d. Drawing and Extrusion Dies

e. Rolling Mills

2. To grind single point and multipoint cutting tools
3. To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
4. To prepare job on shaper involving plane surface,
5. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
6. To determine cutting forces with dynamometer for turning, drilling and milling operations.

Text Books:

1. Manufacturing processes Vol. 1, by H.S. Shan, Pearson Education
2. Manufacturing Engineering & Technology by Kalpakjian, Pearson Publication
3. Sharma P.C., “A Text Book of Production Engineering”, Vol.1, S. Chand Publication, New Delhi, 2001.

BRE621: Robot Kinematics and Dynamics Laboratory

Credits : 1

LTP 002

Course outcomes:

1. Student will be able to differentiate the various types of Robots and their architecture.
2. Student will be able to analyze the applications of robots in various industrial applications.
3. Student will be able to understand the kinematic design and dynamic formulation of typical industrial robot.
4. Student will be able to perform the various types of robot operation with help of Dobot magician robot.

List of Experiments:

1. To study an introduction to Dobot magician robotic arm configuration.
2. To study of ROBOT with 2DOF, 3DOF & 4DOF.
3. To study of various types of end effectors.
4. Visualization and identification of DH Parameter of Robot using Simulation Software.
5. Forward kinematics Analysis of robot using simulation software.
6. Inverse kinematics Analysis of Robot using simulation software.
7. To demonstrate the preformation of dobot magician robot in carrying out color sorting operation.
8. To perform basic pick and place operation by dobot magician robot with using intermediate stage.
9. To perform laser engraving operation on dobot magician robot.
10. To perform 3D printing operation on dobot magician robot.
11. To perform writing and drawing operations on dobot machine using write and draw module in control software.

BMA537: INDUSTRIAL AUTOMATION LABORATORY

Credits : 1

LTP 002

Course Description: This course offers key practical courses similar to those found in our highly successful Hydraulic and Pneumatic Technology program including advanced programming, automation and process controls.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: The student should be able to design hydraulic and pneumatic circuits.

CO2: The student should be able to design and understand the electro-hydraulic and electro-pneumatic circuits.

CO3: Understand various automation tools and methods in manufacturing industry.

CO4: Implement various control and automation method in process industries.

List of experiments:

1. Design and Validate the circuit a small acting cylinder is to extend and clamp a workpiece when push button is pressed as long as push button is activated the workpiece remains clamped in position if the push button is released the clamp is retracted using an additional start button .
2. Design and Validate the circuit a large single acting cylinder is to extend and clamp a workpiece when the push button is pressed. As long as push button is activated the cylinder should remain clamped position if the push button is released the clamper retracted using an additional start button.
3. Design and Validate the circuit a double acting cylinder is to advanced using 3 band operated valves which are positioned at different locations from the cylinder if any of these push buttons are pressed the cylinder must extend cylinder must be retracted position when push buttons are not pressed
4. The allocating device supplies valve blanks to a machining station by operating a push button. The Piston rod of the single acting cylinder is made in advance after releasing the actuation button the

Piston rod Returns. Design and Validate the circuit.

5. Pneumatic system is designed to operate a door of a public transport vehicle assuming that the opening and closing of the doors are controlled by a two button switch that is on and off when the button is in on position the door will open and close when the off button is pressed. Design and Validate the circuit.

6. Design and Validate the circuit a single cycle operation of a double acting cylinder using limit switch and memory valve .

7. Design and Validate the circuit a Single and multi cycle operation of a double acting cylinder using roller LIver valve and memory valve .

8. Design and Validate the circuit a Single cycle automation of multiple cylinders in the sequence A+ B+ A- B-.

9. Design and Validate the circuit an operation of a single acting cylinder using single solenoid valve with indirect actuation of valve.

10. Design and Validate the circuit an operation of a double acting cylinder using double solenoid valve you separate manual control valve for forward and return stroke.

Recommended Books / Suggested Readings:

1. GNA University's Lab Manual on IC Engine.
2. Lab Manual of Janatics and Festo.

BMA536: METROLOGY AND QUALITY CONTROL LABORATORY

Credits : 1

LTP 002

Course Description: The objectives of this course are to learn the main principle on which different instruments operate and provide hands on experience on them and generate knowledge and skill in use of precision instruments. Learn a basic understanding of various instruments used in linear and angular

Course Outcomes (CO):

After completion of the course student will be able to:

1. Develop quality standards of engineering products in industries.
2. Demonstrate work in quality control departments of industries and to ensure quality of products.
3. Analyze the measurement of the surface roughness and perform alignment tests.
4. Develop the ability to apply the principles in instruments and measuring techniques.

List of Experiments:

1. Use of Precision Measuring Instrument (linear and angular) and Gauges
2. Gear parameter measurement, Thread Parameter measurement
3. Calibration of Measuring Instruments
4. Indirect method of measurement using standard balls and rollers
5. Usage of various comparators(mechanical, electrical ,pneumatic etc)
6. Process capability study using mechanical Comparator
7. Various parameter measurement using Computerised profile projector
8. Straightness, flatness measurement using autocollimator
9. Surface roughness measurement
10. Interferometers and measurements using laser.
11. Fundamental measurement using CMM, automatic probing.

BMA601: ADDITIVE MANUFACTURING

Credits : 3

LTP 300

Course Description: This course will teach the fundamentals of Additive Manufacturing (AM) theory and how AM is being used in industry to accelerate product development and its implications on traditional low-volume and high-volume manufacturing processes.

Course Outcomes (CO):

CO1: Understand the working principles and process parameters of additive manufacturing processes.

CO2: Explore different additive manufacturing processes and suggest suitable methods for building a particular component.

CO3: Perform suitable post processing operation based on product repair requirement.

CO4: Design and develop a working model using additive manufacturing Processes.

Unit I

Introduction: Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling – Applications.

CAD & Reverse Engineering: Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology.

Unit II

Liquid Based and Solid Based Additive Manufacturing Systems: Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process.

Unit III

Powder Based Additive Manufacturing Systems: Selective Laser Sintering ,Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

Unit IV

Jmedical and Bio-Additive Manufacturing: Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE).

Text Books:

1. Chua C.K., Leong K.F., and Lim C.S., —Rapid prototyping: Principles and applications‖, Third edition, World Scientific Publishers, 2010.

Suggested Readings:

1. Gebhardt A., —Rapid prototyping‖, Hanser Gardener Publications, 2003.

2. Liou L.W. and Liou F.W., —Rapid Prototyping and Engineering applications: A tool box for prototype development‖, CRC Press, 2007.

3. FDM Guide Book

BMA605: TOOL DESIGN

Credits : 3

LTP 300

Course Description: This course aims to teach the students about the design of dies for bending, forming, drawing and forging. This also includes the understanding of the cost accounting methods and the time calculation techniques.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

1. Describe tool design methods and punch and die manufacturing techniques
2. Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature
3. Describe the principles of clamping, drill jigs and computer aided jig design
4. Design fixtures for milling, boring, lathe, grinding, welding; identify fixtures and cutting tools for NC machine tools
5. Explain the principles of dies and moulds design
6. To estimate the cost of die using cost estimation methods.

Course Content:

Unit I

Terminologies and operations: Types of presses, Press Accessories, Computation of press capacity, Material Utilization, Press Work Materials, Center of pressure, Difference between bending, forming and drawing, Types of Bending dies, Ejectors, Variables affecting Metal flow in drawing operations, draw die inserts, Design and development of bending, forming, drawing reverse re-drawing and combination dies

Unit II

Blank development for axi-symmetric, rectangular and elliptic parts, Single and double action dies, Fundamentals of die-cutting operations, Cutting action in punch and die operations, Die clearance, Blanking and Piercing Die construction, Pilots, Strippers and Pressure Pads, Strip layout, Design of simple progressive and compound die sets, Forging Die, Flow lines, parting lines, open and close die forging

Materials for die block, Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies, recent trends in tool design, computer Aids for sheet-metal forming Analysis, tooling for numerically controlled machines, Single minute exchange of dies.

Unit III

Cost accounting or costing: Elements of cost, Methods of cost estimation, Data requirement for cost estimating, steps in making a cost estimate, Chief factors in cost estimating, Numerical examples, Calculation of machining times.

Unit IV

Jigs and Fixtures: Objectives of jigs and fixtures,Types of Jigs, Post, Turnover, Channel, latch, box, pot, angular post, indexing jigs, General principles of milling, Lathe, boring, broaching and grinding fixtures, Assembly, Inspection and Welding fixtures, Modular fixturing system, Quick change fixtures, Work holding equipment.

Text Books:

1. O.P. Khanna : A Textbook of production Engineering
2. P.C. Sharma : A Textbook of production Engineering, S. Chand Publication, New Delhi, 2nd edition

Suggested Readings:

1. Donaldson : Tool Design, McGraw Hill, New York, 3rd edition, Tata McGraw-Hill
2. Jeff Lantrip, David A. Smith and John G. Nee, (2003) Fundamentals of Tool Design, 5th Edition
3. Cole, C. B. : Tool Design, American Technical Society Pub., Chicago,1963
4. ASTME : Fundamental of Tool Design, Prentice Hall, 3rd edition, Society of Manufacturing

Web Links:

1.http://fritzing.org/media/uploads/publications/Knoerig08_DesignToolsDesign.pdf
2.https://uni.edu/~rao/Mfg%20Tooling%20-04%20Cutting%20tool%20design.pdf
3.http://www.erode-sengunthar.ac.in/dept/lm/MECH/DJF/Design%20of%20dies.ppt

BRE606: Product Life Cycle Management

Credits : 3

LTP 300

Pre-Requisites:

Course Objectives:

1. To anticipate the consequences of intended action or inaction and understand how the consequences are managed collectively by your organization, project or team
2. To integrate a system for corrective and preventative action to track production quality issues
3. To work collaboratively and share data across geographically dispersed team and value chains.

Course Outcomes (CO):

1. To identify and assess risks (including OH&S) as well as the economic, social and environmental impacts of engineering activities
2. To develop and operate within a hazard and risk framework appropriate to engineering activities
3. To apply systematic approaches to the conduct and management of engineering projects
4. To demonstrate professional use and management of information.
5. To know legal, social, economic, ethical and environmental interests, values, requirements and expectations of key stakeholders
6. To assess, acquire and apply the competencies and resources appropriate to engineering activities.

Course Content:

Unit I

Introduction to Product Life Cycle Management: Product life cycle - Introduction, growth, maturity & decline, Product Lifecycle Management- Definition & Overview, Background for PLM-corporate challenges, Need of PLM, Components/Elements of PLM, Emergence of PLM, Significance of PLM - life cycle problems to be resolved, product development problems to be resolved, Customer Involvement.

Constructing Product Life Cycle Management: PLM Life cycle model- plan, design, build, support & dispose, Threads of PLMcomputer aided design (CAD), engineering data management (EDM), Product data management (PDM), computer integrated manufacturing (CIM), Weaving the threads into PLM, comparison of PLM to Engineering resource planning (ERP), PLM characteristics -singularity, cohesion, traceability, retlectiveness.

Unit II

Product Life Cycle Management – Drivers: External drivers- scale, complexity, cycle times, globalization & regulation, internal drivers - productivity, innovation, collaboration & quality, Boardroomdrivers - income, revenues & costs.

Product Life Cycle Management System: Product life cycle management system- system architecture, Information models and product structure, Information model, the product information data model, the product model, functioning of the system. Reasons for the deployment of PLM systems.

Unit III

Product Life Cycle Environment: Product Data and Product Workflow, The Link between Product Data and Product Workflow, Key Management Issues around Product Data and Product Workf1ow, Company's PLM vision, The PLM Strategy, Principles for PLM strategy, Preparing for the PLM strategy, Developing a PLM strategy, Strategy identification and selection, Change Management for PLM.

Unit IV

Components of Product Life Cycle Management: Different phases of product lifecycle and corresponding technologies, Product development processes and methodologies, Foundation technologies and standards (e.g. visualization, collaboration and enterprise application integration), Core functions (e.g., data vaults, document and content management, workflow and program management), Functional applications (e.g., configuration management) Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards, Examples of PLM in use.

Text Books:

1. AnttiSaaksvuor,IAnselmiImmonen, Product Life Cycle Management -Springer, l st Edition (Nov.5, 2003)

2. Stark, John. Product Lifecycle Management: 2 lst Century Paradigm forProduct Realization, Springer-Verlag, 2004. ISBN 1852338105

Suggested Readings:

1. Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean Thinking, McGraw-Hill, 2006. ISBN 0071452303

2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

BMA621: ADDITIVE MANUFACTURING LABORATORY

Credits : 1

LTP 002

Course Description: To make students understand the wide range of additive manufacturing processes, capabilities and materials. To provide comprehensive knowledge on the various software tools and techniques that enable additive manufacturing and students learn to create physical objects that satisfies product development/prototyping.

Course Outcomes (CO):

CO1: Demonstrate appropriate levels of understanding on the principles of additive manufacturing processes.

CO2: Demonstrate competency in the use of materials for additive manufacturing processes.

CO3: Demonstrate the methodology of CAD tools and CAD interface with additive manufacturing systems.

CO4: Identify suitable additive manufacturing process, define optimum process parameters and develop physical prototypes using suitable additive manufacturing systems.

Course Content:

List of Experiments:

1. Practical Implementation and comparison of various Rapid Prototyping Technologies.
2. Practical Demonstration of FDM Printing.
3. To import CAD STL file of the part to be printed in Catalyst Software and set part orientation, units and scale.
4. To add the print model to pack and analyze model and support material requirement and time consumption for the printer.
5. To prepare the Work Table and set up the Material Cartridges in Dimension SST 1200ES for proper loading and unloading.
6. To send the print file to FDM Machine and produce the RP Model.
7. To perform machine maintenance and verify the stable condition of machine nozzles.

Suggested Readings:

1. Gebhardt A., —Rapid prototyping‖, Hanser Gardener Publications, 2003.

2. Liou L.W. and Liou F.W., —Rapid Prototyping and Engineering applications: A tool box for prototype development‖, CRC Press, 2007.

3. FDM Guide Book

BMA625: TOOL DESIGN LABORATORY

Credits : 2

LTP 004

List of Practical's:

1. Complete core and cavity generation of pressure die casting component (choke cover)
2. Complete core and cavity generation of forging component (flange forging)
3. Complete core and cavity generation of forging component (rottle forging)
4. Complete core and cavity generation of sand-castingcomponent(gear box)
5. Complete core and cavity generation of injection molding componet(grinder middle cover)
6. Complete core and cavity generation of sheet metal (sheet frame).

BMA703: COMPUTER AIDED MANUFACTURING

Credits : 3

LTP 300

Course Description: In this course students will be leaning the basic technical computer aided design and manufacturing skills along with the practical exposure to the latest machines and methods used in the industry. The students will also learn about the concept rapid prototyping and its various types.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: To identify the main machine elements in advance manufacturing systems.

CO2: To apply knowledge of computer numeric control, create and validate NC part programming.

CO3: To understand computer aided manufacturing processes using CAM software and apply on die's/moulds manufacturing.

CO4: To explore different types of counter milling operations and its application in components/ mould and die's.

CO5: To know about different types of post processor and DNC concept using in digital manufacturing processes.

Course Content

Unit I

Basic Concepts: Fundamental of conventional manufacturing processes, advance manufacturing processes, NC, CNC, EDM, Wire cut, CNC Plasma cutting Machines and their functions and applications.

Fundamental of control system and part programming: Concept of cutting tools and cutting parameters, machine parameter, geometry codes (G Code), machine/miscellaneous code (M-code) and different type of control system.

Unit II

Computer aided manufacturing Data migration using multi-CAD systems to CAM system. NX manufacturing process for mould/dies: core, cavity, slider & insert.

Contour Milling Operations: Fundamental of Contour Milling operation; roughing operation, rest roughing, semi finishing and super finishing and details cavity milling operations.

Unit III

Rest roughing operation: Cavity milling with IPW

Finishing operations: Fixed contour (area milling), Z-level profile, Contour text

Super finishing operations: Flow cut (single, multiple, ref. Tool diameter), Stream line

Unit IV

Mill planer operations and DNC concept: Face milling (floor and wall), Planer milling, Hole making. Types & functions of direct numeric control (DNC), its benefits and advantage.post process interface, NC code generate with CAM programming.

Text Books:

1. CAD/CAM: Computer-aided Design and Manufacturing by Mikell Groover
2. Computer-aided manufacturing by Tien-Chien Chang

Web Links:

http://nptel.ac.in/courses/112102101/

https://www.slideshare.net/dhopsanda/computer-aided-manufacturing-76820767

BRE602: PLC PROGRAMMING

Credits : 3

LTP 300

Course Objectives: This course includes the introduction to PLC and its programming with ladder logic diagrams. It also includes the advance PLC functions and the various applications of the PLC.

Course Outcomes:

1. To explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.
2. To explain the concept of basic digital electronics and data manipulation.
3. To be able to use timer, counter, and other intermediate programming functions.
4. To design and program basic PLC circuits for entry-level PLC applications.
5. To make the students understand various types of PLC registers.

To design and program a small, automated industrial production line

Course Content:

Unit I

Introduction to PLC Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, Definition, types, selection criterion, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, Solid state memory , advantages and disadvantages

Unit II

Programming of PLC Programming equipment, Various techniques of programming, Ladder diagram fundamentals, proper construction of ladder diagram, basic components and their symbols in ladder diagram, MCR (master control relay) and control zones, Boolean logic and relay logic. Timer and counter- types along with timing diagrams, shift registers, sequencer function, latch instruction. Arithmetic and logical instruction with various examples.

Unit III

Advance PLC function Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs. Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface, and Industrial process example.

Unit IV

Applications of PLC: PLC interface to various circuits : Encoders, transducer and advanced sensors (Thermal, Optical, Magnetic, Electromechanical, Flow, Level sensors), Measurement of temperature, flow, pressure, force, displacement, speed, level, Developing a ladder logic for Sequencing of motors, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

Text Books:

1. Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition
2. Bennett Stuart, "Real Time Computer Control", Prentice Hall, 1988
3. Doebelin E. O., "Measurement Systems", McGraw-Hill International Editions, Fourth Edition, 1990
4. Gordan Clark, Deem Reynders, "Practical Modern SCADA Protocols", ELSEVIER
5. Krishna Kant, "Computer Based Industrial Control", PHI
6. M. Chidambaram, "Computer Control of Process", Narosha Publishing
7. P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications
8. Poppovik, Bhatkar, "Distributed Computer Control for Industrial Automation", Dekkar Publications
9. S. K. Singh, "Computer Aided Process Control", PHI 10. Webb J. W, "Programmable Controllers", Merrill Publishing Company, 1988.

Suggested Readings:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition
2. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers
3. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition
4. Ronald L. Krutz, "Securing SCADA System", Wiley Publications.
5. Sunil S. Rao, "Switchgear and Protections", Khanna Publications.

6. L.A. Bryan, E. A. Bryan, “Programmable Controllers Theory and Implementation” Industrial Text Company Publication, Second Edition

Web Links:

1.https://www.slideshare.net/veenitamore2/ppt-on-plc

2.http://www.engr.psu.edu/cim/ie450/ie450pp10.ppt

3.http://www.d.umn.edu/~snorr/ece4501s10/lecturePLC.ppt

4.http://www.ieec.uned.es/investigacion/Dipseil/PAC/archivos/introtoplcs_SUPER.pdf

5.https://booksite.elsevier.com/9781856176217/appendices/01~Ch11.pdf

6.http://nptel.ac.in/courses/108105063/pdf/L-19(SM)%20(IA&C)%20((EE)NPTEL).pdf

BMA723: COMPUTER AIDED MANUFACTURING LABORATORY

Credits : 2

LTP 004

List of experiments:

1. Generate CNC program using post processor file (PPR) according to the control system of CNC machines.
2. Manufacturing processes of Die cutting.
3. Fundamentals of DNC system and its application.

BRE622: PLC Programming Laboratory

Credits : 1

LTP 002

List of experiments:

1. Interfacing of lamp & button with PLC for ON & OFF operation. Verify all logic gates.
2. Performed delayed operation of lamp by using push button.
3. UP/DOWN counter with RESET instruction.
4. Combination of counter & timer for lamp ON/OFF operation.
5. Set / Reset operation: one push button for ON & other push button for OFF operation.
6. DOL starter & star delta starter operation by using PLC.
7. PLC based temperature sensing using RTD.
8. PLC based thermal ON/OFF control.
9. Interfacing of Encoder with PLC (Incremental/Decremental)
10. PLC based speed, position measurement system.
11. PLC interfaced with SCADA & status read/command transfer operation.

BMA700: MAJOR PROJECT

Credits : 2

LTP 004

Course Description: This course aims to provide the opportunity to the students so that they can apply what they have learnt in previous stages in a real-life engineering context.

Course Outcomes:

On successful completion of the course students will be able to:

Co1: Demonstrate a sound technical knowledge of their selected project topic.

Co2: Undertake problem identification, formulation and solution.

Co3: Apply engineering knowledge in analysis of problems and synthesis of solution while considering various constraints

Co4: Communicate with engineers and the community at large in written and oral forms.

Co5: Demonstrate the knowledge, skills and attitudes of a professional engineer.

In the Final Year (7th/8th Semester), students have to submit their Major project along with report to the concerned faculty.

GUIDELINES FOR STUDENTS AND FACULTY:

1. Students have to finalize their project title based on Project Synopsis.
2. The projects selected should be so as to ensure the satisfaction of the urgent need to establishing a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.
3. Project topics may be chosen by the student or group of students with advice from the faculty members.
4. The design of a project may be based on

(i) Entirely on study and analysis of a typical Instrumentation and Control System,

(ii) Experimental verification, or

(iii) Design, fabrication, testing and calibration of an Instrumentation system.

(iii) Software based project can also be considered based on its application

5. The students are required to prepare and submit the project report using appropriate tools.

6. Each student/group is required to

a. Submit one page synopsis before the project talk in the first week of their academic semester.

b. Give a 10 minutes presentation followed by a 10 minute discussion in the second week of their academic semester.

c. Submit a detailed summary report which includes project title, list of required hardware, software or other equipment for executing the project by the third week of their academic semester.

d. Start working on the project and complete initial development and CPM/PERT planning drawing in the fourth week of their academic semester.

e. PCB layout, wiring diagram, purchase of components, software demo, flowchart, algorithm, program/code, assembling, testing, etc. wherever required should be arranged or completed by student/s and mid-term presentation of the progress made be undertaken.

f. Overall assembling, wiring, code writing, testing, commissioning etc. should completed by next two weeks.

g. At the last but one week of end of academic semester the internal assessment of project will be done by panel of internal faculties. In the last week, student/group will submit final project report to guide.

7. Projects are to be scheduled in the weekly scheduled time-table during the semester and any change in schedule should be discouraged.

8. Every assigned faculty/s should maintain separate file for evaluating progress of each student or group.

9. The format and other guidelines for the purpose of the Project Submission in hard bound copies should be as follows,

REPORT STRUCTURE

TITLE PAGE

CANDIDATE DECLARATION duly signed by student and Supervisor

ACKNOWLEDGEMENT Expression of gratitude and thankfulness for helping in completion of the said task with name Signed by the candidate

ABSTRACT

CONTENTS Index/Contents/Intent List of Abbreviations List of Figures List of Graphs List of Tables and any other inclusion

1. INTRODUCTION

1.1 Introduction

1.2 Necessity

1.3 Objectives

1.4 Theme

1.5 Organization

2. LITERATURE SURVEY Literature Survey Related information available in standard Books, Journals, Transactions, Internet Websites etc. till date (More emphasis on last three to five years).

3. SYSTEM DEVELOPMENT

Model Development Analytical Computational Experimental Mathematical Statistical (out of above methods at least one method is to be used for the model development).

4. PERFORMANCE ANALYSIS

Analysis of system developed either by at least two methods depending upon depth of standard.

These methods normally used are Analytical /Computational/ Statistical/ Experimental/ or Mathematical.

Results at various stages may be compared with various inputs

Output at various stages with same waveforms or signals or related information /parameters

Comparison of above results by at least two methods and justification for the differences or error in with theory or earlier published results.

5. CONCLUSIONS

5.1 Conclusions

5.2 Future Scope

5.3 Applications Contributions (if any,) the innovative work/invention/new ideas generated from the analysis of the work which can be taken from the conclusions.

REFERENCES Author, "Title", Name of Journal/Transactions/ Book, Edition/Volume, Publisher, Year of Publication, page to page (pp.__). These references must be reflected in text at appropriate places in square bracket. In case of web pages complete web page address with assessing date has to be enlisted List of references should be as per use in the text of the report.

APPENDICES Related data or specifications or referred charts, details computer

code/program, etc. (1 Page)

General Guidelines Text should be printed on front and correct side of the watermark on quality bond paper Paper size- A4, 75 to 85 gsm paper Left Margin-1.5" Right Margin-3/4" Top Margin-1" Bottom Margin-1"

Report Heading -All Capital—16 Font; Chapter heading -All Capital—14 Font; Subchapter –title case-12 Font; Sub-Subchapter –First Alphabet Capital case-12 Font; Page numbers for Index/Contents/Intent should be in roman; Title of the Report should not be more than two lines; Text pages should be in Times New Roman.

BRE800: Industrial Training

Credits : 10

LTP 000

Course Description: The Industrial Training provides students with the opportunity to intern in the professional setting of a company, and help develop their abilities as a professional. The duration of Industrial Training is of one semester long and it's offered during the eight semester after the students have completed three and a half years of course work, which consists of a judicious mix of Foundation, Skill, Perspective, Core and Elective courses. Industrial Training is an integral part of the curriculum.

Course Outcomes:

After completion of this semester long course the student trained in his specialized area of operation

CO1: Will be able to critically think, observe and communicate

CO2: Will acquire the work experience through advance learning (in terms of depth, complexity and engagement) in an industrial environment

CO3: Will be able to apply, extend and test the knowledge gained from class room experience to understand and mitigate complex issues and address real industry challenges

Co4: Will be able to assimilate technical and administrative or managerial skills from his interactions with a variety of individuals, systems and practices

Professional Elective Courses

BRE441: Micro-controller and Micro-processor

Credits : 3

LTP 300

Course Description: This course includes the introduction to 8086/8051 microprocessor. The studendts will be equiped with the knowledge of the hardware and softwere used in mocroprocessors and microcontrollers.

Course Outcomes (CO):

1. The student will learn the internal organization of popular 8086/8051microprocessors/microcontrollers
2. To learn hardware and software interaction and integration.
3. To understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller.
4. To design circuits for various applications using microcontrollers.
5. To apply the knowledge of microprocessor on real- time applications.
6. To gain the knowledge of logical development of programs on the 8086 and 8051 processors.

Course Content

Unit I

Introduction to 8085 Microprocessor: Evolution of microprocessors and computers-Intel 8085 architecture- functions of various blocks and signals- addressing modes-instruction set-simple program- basic timing diagrams.

Unit II

Peripheral Interfacing: Data transfer schemes- interrupts- software interrupt- programmable interrupt controller 8259- programmable peripheral interface 8255-programmable interval timer 8253-programmable communication interface 8251 USART-DMA controller 8257.

Unit III

Introduction to 8086 Microprocessor: Architecture of 8086-minimum mode-maximum mode and timings-instruction set-addressing modes-assembler directives-interrupts-simple programs.

Introduction to 8031/8051 Microcontrollers: Role of microcontrollers-8 bit microcontrollers-architecture of 8031/8051-Signal description of 8051-register set of 8051-instruction set-addressing modes- simple programs.

Unit IV

Interfacing And Applications: Stepper motor control-keyboard interfacing, alpha-numeric display interfacing- analog to digital converter interfacing- digital to analog converter interfacing- interfacing of electronic weighing bridge.

Text Books:

1. A.K Roy and K.M Bhurchandi, “Advanced Microprocessors and Peripherals” McGraw-Hill International.
2. Douglas V Hall, “Microprocessors and Interfacing Programming and Hardware” Tata McGraw-Hill.

Suggested Readings:

1. Ramesh .S. Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085” Penram International.
2. Muhammed Ali Mazadi and Janice GilliMazdi. “The 8051 Microcontroller and embedded systems” Person Education.

BRE442: Automobile Engineering

Credits : 3

LTP 300

Course Description: The students will be equipped with the knowledge of an Automobile, its types, the various components of it. The students will also gain knowledge on the functioning of each components of an automobile.

Course Objectives:

1. To make the student learn about the location and importance of each part.
2. To make the students understand about the functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels.
3. To get them learn about suspension, frame, springs and other connections.

Course Outcomes:

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

1. Identify the different parts of the automobile.
2. Explain the working of various parts like engine, transmission, clutch, brakes.
3. Describe how the steering and the suspension systems operate.
4. Understand the environmental implications of automobile emissions.
5. Develop a strong base for understanding future developments in the automobile industry.
6. Troubleshoot the automobile.

Course Content:

Unit I

Vehicle Power Systems: Automobiles are the vehicles which have the capacity of covering distances without any human or animal force. The engines or motors enable the movement of these vehicles in many forms. The current topic discusses few of those power systems.

Prime Movers & Energy Sources: Petrol/diesel engines, electric motors, turbines, fuel cells, etc. (overview of applications), basic functions and arrangement of components.

Components of vehicle: Basic structure, power unit, transmission system, accessories, superstructure.

Unit II

Layout of Conventional Type Vehicle: Front engine rear wheel drive Vehicle Dimensions: Wheelbase, wheel track, front & rear overhang, overall dimensions, ground clearance.

Vehicle Transmission and Suspension System: Transmission system, as the name suggests transmits the power produced by the engine or motor to the wheels. Further this transmission process enables the movement of the vehicle. The current topic discusses the transmission system as well as the Suspension System.

Suspension system is used to reduce the road vibrations and at the same time to increase the road holding/handling capabilities of the vehicle. The topic discusses the major components of the Suspension system.

Gear Box: Functions and types of gearbox.

Unit III

Clutch: Purpose and requirements of clutch, Type - Single plate, multi plate, dry, wet, semi centrifugal, centrifugal.

Braking Systems: Purpose, principle of braking, stopping distance, layout of braking system components, Braking efficiency, classification of brakes, requirements of a good braking system.

Suspension System: Basic functions of suspension system, Types - Independent and rigid, coil, leaf, torsion bar, air, rubber suspension (Elementary idea), Conventional leaf spring rigid beam suspension for light vehicle and with helper spring for heavy vehicles.

Tyres: Functions of tyres, Classification - solid, pneumatic, high low and extra low-pressure tyre, tubed and tubeless tyre, cross ply, belted bias and redial ply tyre, Cross section of a pneumatic tyre, Specification of tyres, Desirable tyre properties.

Unit IV

Final Drive: Functions, types and constructional details of - Propeller shafts, Universal joints, Sliding joint, Differential – Principles & functions, Different types of rear axles according to methods of supporting

Front Axle and Steering System: Front axle – types, front wheel stub axle assembly, purpose and requirements of steering system, general arrangement of steering systems steering, steering system components - steering wheel, steering column, conventional steering linkage, steering and ignition lock.

Vehicle Structure & Materials: The topic briefly talks about the major components of a Vehicle Structure and understand their impact in designing a vehicle. Also, a study of materials related to the structure is done. More detailed study of materials will be done in the next semester.

Frame: Function of frame, loads or frame, frame construction, sub-frame, defects in frame chassis repair and alignment, frame less construction

Body: Types and construction (parts of body), main features - strength, stiffness, space air drag, stream lining, weight, vibration, protection against weather, corrosion, safety and economic considerations, body alignment, bumpers - types and functions, denting and painting, window regulators, doors, hood, dashboard, glasswork.

Materials: Components categories, classification of materials, functionality considerations, factors influencing selection of such materials.

Text Books:

1. Automobile Engineering Vol. 1 & 2 by Kirpal Singh

2. Kamaraju Ramakrishna, "Automobile Engineering", PHI Learning, New Delhi, 1st Print, 2012.

3. Jain &Asthana, "Automobile Engineering", Tata McGraw-Hill, New Delhi, 2002.

Suggested Readings:

1. Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata McGraw Hill, 2010.

2. Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.

3. Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd ed., Tata McGraw Hill, 2001

BRE443: Data Structure and Algorithms

Credits : 3

LTP 300

Course Objectives: The students will be equipped with the basic programming using C++.

Course Outcomes:

1. To write programs using object-oriented design principles.
2. To understand advanced use of arrays in C++ programming.
3. To be familiar with using C++ structures.
4. To be familiar with using pointers and reference parameters
5. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heapss, binary search trees, and graphs and writing programs for these solutions.
6. To be familiar with issues related to software design

Course Content:

Unit I

Introduction: Concept of data structure, Types of data structures, Character String in C, Recursion, Structure, Pointer, Dynamic Allocation, Algorithms, Algorithm analysis, Complexity of algorithms and Time space trade-off.

Arrays: Introduction, Single and multi-Dimensional Arrays, address calculation, application of arrays, Operations defined: traversal, insertion and deletion.

Unit II

Stacks: Stacks, Array representation of stack, Applications of stacks, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack

Queue: Queue, Array representation and implementation of queues, Circular queues, Operations on Queue: Create Add, Delete, and Full and Empty, De-Queue, Priority queues, Applications of Queues.

Unit III

Linked Lists: Concept of linked list, Representation and implementation of singly linked list, Circular linked list, doubly linked list, Operations on Linked lists, Concepts of header linked lists, applications of linked lists

Unit IV

Trees: Basic terminologies of trees, Binary tree, Complete Binary tree, Extended Binary tree, Representation of Binary tree, Binary tree traversal, Operations on Binary tree.

Binary Search Tree: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees

Text Books:

1. "Data Structures" Schaum's Outline Series,Lipschutz, TMH
2. Data Structures and Program Design in C By Robert Kruse, PHI
3. Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H

Suggested Readings:

1. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub
2. "Fundamentals of Data Structures", Horowitz and Sahani, Galgotia Publication

BRE424: Micro-controller and Micro-processor Laboratory

Credits : 1

LTP 002

List of experiments:

1. Addition and subtraction of 8 bit numbers
2. Addition and subtraction of 16 bit numbers
3. Multiplication of two 8 bit numbers
4. Division of two 8 bit numbers
5. Sorting numbers in ascending order and descending order
6. Sum of series of N numbers
7. Code conversion to BCD to Binary and Binary to BCD
8. Stepper motor control
9. Interfacing of Analog to digital converter (ADC)
10. Interfacing of Digital to Analog converter (DAC)
11. Interfacing of traffic light control systems
12. Keyboard/Display Interface
13. Rolling display
14. Flashing display

BRE425: Automobile Engineering Laboratory

Credits : 1

LTP 002

List of experiments:

1. Valve refacing and valve seat grinding and checking for leakage of valves
2. Trouble shooting in cooling system of an automotive vehicle
3. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
6. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
7. Replacing of ring and studying the method of replacing piston

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BRE426: Data Structure and Algorithms Laboratory

Credits : 1

LTP 002

List of experiments:

1. Write a program which accept information about five student and display same information according to ascending order of their name.
2. Write a program to implement stack.
3. Write a program to convert infix expression into postfix expression.
4. Write a program to evaluate postfix expression.
5. Write a program to implement queue.
6. Write a program to implement circular queue.
7. Write a program to implement link list with insert, delete, search, view, and delete function
8. Write a program to implement ordered link list
9. Write a program to add two polynomials
10. Write a program to create doubly link list
11. Write a recursive program to find factorial and to print fibonacci series
12. Write a program to implement tree with insert, delete and search function
13. Write a program for inorder, postorder and preorder traversal of tree
14. Write a program for binary search

BMA645: NON-DESTRUCTIVE TESTING

Credits : 3

LTP 300

Course Description: To impart knowledge in various methods of Non Destructive Testing and overview the concepts, principles, and methods employed for NDT of structures and materials also understand the different NDT techniques and their applications.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain the basic principles of various NDT methods.

CO2: Should tell the fundamentals, importance of NDT, applications, limitations of NDT methods.

CO3: understand various techniques and codes, standards and specifications related to non-destructive testing technology.

CO4: determine the suitability of application of NDT technique for different materials.

Course Content:

Unit I

Introduction: Classification of techniques of material testing, Need and Significance of Non Destructive Testing methods, type of Non Destructive testing methods. 2. Radiographic Examination: Radiant energy and radiography, practical applications, X-ray and Gamma –ray equipment, effect of variables on radiographs, requirement of a good radiograph, interpretation of radiograph, safety precautions, Xeroradiography.

Unit II

Magnaflux methods: Basic principles, scope and applications, magnetic analysis of steel bars and tubing magnetization methods, equipment, inspection medium, preparation of surfaces Fluorescent Penetration inspection, Demagnetization.

Unit III

Electrical and ultrasonic Methods: Basic principles, flaw detection in rails and tubes (Sperry Detector), Ultrasonic testing surface roughness, moisture in wood, Detection of defects in ferrous and non ferrous metals, plastics, ceramics, measurement of thickness, hardness, stiffness, sonic material analyzer, proof tests, concrete test hammer.

Unit IV

Photoelasticity: Concept and applications of Plane and circular polarization, Photo stress, models.

Text Books:

1. Practical Non-destructive Testing by Baldev Raj, T. Jayakumar, M. Thavasimuthu, Woodhouse Publishing Limited.
2. Non-destructive Testing Techniques by Prakash Ravi, New Age Science.
3. Non-Destructive Test and Evaluation of Materials by J .Prasad and C. G. Krishnadas Nair, Tata McGraw-Hill Education.

Suggested Readings:

1. W.H Armstrong, Mechanical Inspection, Mc Graw Hill.
2. H.E. Davies, G.E Troxell and GFW Hauck, The testing of Engg materials, Mc Graw Hill.

Web Links:

1.https://www.slideshare.net/kirtisingh2011/nanotechnology-ppt

2.https://www.biicl.org/files/4460_lwdlib02-%232319260-v2-biicl_presentation.ppt

3.http://dte.kar.nic.in/STDNTS/Nano(KM).pps

4.https://www.etui.org/content/download/21082/176155/file/ETUI_NanoPres_2_What%20is%20nano.pptx

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BMA646: OPERATION RESEARCH

Credits : 3

LTP 300

Course Description: This courseaims to aware the students of the various techniques of operations research so that they can apply these techniques to solve real life problems. This course intend to teach students how to use critical path analysis and programming evaluation production and review techniques for timely project scheduling and completion.

Course Outcomes (CO):

Students completing this course should be able to:

1. Turn real life problems into formulation of mathematical models to be solved by linear programming
2. Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
3. Employ the various queuing models and understand when and how to use them to calculate optimal queuing solutions.
4. Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network

Course Content

Unit I

Introduction : Origin of OR and its role in solving industrial problems : General approach for solving OR problems. Classification of mathematical models: various decision making environments.

Linear Programming: Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis (

Unit II

Transportation and Assignment Models: Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function.

Dynamic Programming: Introduction to deterministic and probabilistic dynamic programming.

Unit III

Queuing Theory: Types of queuing situation: Queuing models with Poisson's inputand exponential service, their application to simple situations.

Replacement Models: Replacement of items that deteriorate, Replacement ofitems whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with timeand value of money also changes, individual replacement policy, group replacement policy.

Unit IV

Network models: Shortest route and traveling sales - man problems, PERT &CPM introduction, analysis of time bound project situations, construction of net works,identification of critical path, slack and float, crashing of network for cost reduction.

Non-linear Programming Models: Introduction to non-linear programming models. Problems related to the topic.

Text Books:

1. H.M Wagner, Principles of Operations Research, Prentice Hall.
2. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co.

Suggested Readings:

1. F.S. Hiller and G.I. Libermann, Introduction to Operation Research, Holden Ray.
2. A Management Guide to PERT/CPM Wiest & Levy Prentice Hall

Web Links:

1.http://nptel.ac.in/courses/112106134/1
2.https://www.slideshare.net/dharmendragahwai/operational-reseach-ppt
3.http://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf

BMA647: TRIBOLOGY

Credits : 3

LTP 300

Course Description: This course aims to equip the students with basic understanding of friction, lubrication, and wear processes.

Students will also become familiar with mathematical tools used to analyze tribological processes.

Course Outcomes (CO):

1. Students will become familiar with common anti-friction and anti-wear components and the lubricants used therein.
2. Students will be able to describe the detailed operation of selected anti-friction or anti-wear components.
3. Students will be able to design a tribological system for optimal performance.
4. Students will be able to develop technical project reports and technical presentations.

Course Content

Unit I

Introduction: Tribological considerations, Nature of surfaces and their contact, Physic mechanical properties of surface layer Geometrical properties of surfaces, methods of studying surfaces, Study of contract of smoothly and rough surfaces.

Unit II

Friction and Wear: Role of friction and laws of static friction, causes of friction , adhesion theory, Laws of rolling friction, Friction of metals and non-metals; Friction measurements. Definition of wear, mechanism of wear, friction affecting wear, wear measurement, Wear of metals and non-metals.

Unit III

Lubrication and Lubricants: Introduction, dry friction, Boundary lubrication, classic hydrodynamics, hydrostatic and elasto hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses, properties of liquid and grease lubricants; lubricant additives , general properties and selection.

Unit IV

Special Topics: Selection of bearing and lubricant, bearing maintenance, diagnostic maintenance of tribological components, lubrication systems, Filters and filtration.

Text Books:

1. O'Conner and Royle, Standard Hand Book of Lubrication Engg., McGraw Hill.
2. Halling and Wykeham, Introduction to Tribology, Publications Ltd

Suggested Readings:

1. Raymono O.Gunther, Lubrication, Bailey Bros and Swinfan Ltd.
2. PT Barwll, Rearing Systems, Principles and Practice,Oxford press.
3. A Cameron, Basic Lubrication Theory, Wiley (Indian Edition).

Web Links:

1.http://nptel.ac.in/courses/112102015/

2.https://www.slideshare.net/energyravindran/ppt-on-tribologypp

3.http://allaboutmetallurgy.com/wp/wp-content/uploads/2016/12/Introduction-to-Tribology.pdf

BRE745: Flexible Manufacturing System

Credits : 3

LTP 300

Course Description: Students willgain knowledge on how computers are integrated at various levels of planning and manufacturing understand computer aided planning and control and computer monitoring.

Course Outcomes (CO):

1. Apply the concepts of PPC and GT to the development of FMS.
2. Discuss the planning and scheduling methods used in manufacturing systems.
3. Identify various workstations, system support equipment's.
4. Identify hardware and software components of FMS.
5. Summarize the concepts of modern manufacturing such as JIT, supply chain management and lean manufacturing etc
6. Understand the automatic material handling system.

Course Content

Unit I

Introduction: Evolution of transformation & manufacturing systems, Need of attitude, knowledge & skill required for application of manufacturing systems, Need for system approach, Role of computers and information technology in manufacturing and manufacturing systems, Product life cycle & its importance, Technology life cycle, Scope, importance and challenges in Indian context to manufacture products at international competitive price with better quality& innovation.

Group Technology (GT) & Cellular Layout: GT - concept, definition, need, scope, & benefits, Production layout-types, features and applications, GT Layout -concept, need, benefits, comparison with conventional layout with examples, GT- codification systems- types, method of coding and examples, Part features- concept, types and examples, Part family- concept, method to form and approach to form cell using part families, Types and comparison of cell: manual and automatic cell, assembly cell, Steps of cell design and cell layout.

Unit II

Flexible Manufacturing System (FMS): Flexible Manufacturing System (FMS) –concept, definition and comparison with other manufacturing systems, Major elements of FMS and their functioning: Tool handling system, Material handling system, Automated guided vehicles (AGV), Automated storage and retrieval system (AS/RS), Main frame computer, FMS layout - concept, types and applications, Data required developing an FMS layout, Signal flow diagram and line balancing in FMS, FMS layout illustrations (Minimum two).

Unit III

Programmable Logic Controller (PLC) &MicroControllers (MC): Role of control system in instrumentation, Open and close loop control system, types and block diagram, Servomechanism and regulators with suitable examples, Basic control actions - on-off, proportional, derivative, integral control, proportional derivative (PD), proportional integral (PI), p proportional integral and derivative (PID) control, Basic digital logic gates symbol, operation, truth-table and examples of Manufacturing Systems Course, PLC: Concept, general constructional features, types of diagrams, working and major applications in manufacturing systems, Use of SCADA (Supervisory Control And Data Acquisition) in PLC design, Microcontrollers: introduction, hardware components, i/o pins, ports; selection of micro controllers & embedded controllers, applications.

Unit IV

Computer Integrated Manufacturing Systems: Recent Trends Identify the applications of various advance techniques used in manufacturing, Computer Aided Process Planning (CAPP) - concept, types, features, methods and importance, Computer Integrated Manufacturing (CIM): need, block diagram, functional areas covered and their importance, Protocols in CIM- their features, functions and applications, Computer Aided Inspection (CAI) - concept, benefit, types, working and examples. Coordinate Measuring Machine (CMM) - its working and application, Rapid Prototyping (RP): working principles, methods, applications and limitations, rapid tooling, techniques for rapid prototyping, Artificial intelligence- concept, definition and application areas, neural network: working principles, applications and limitations, Lean manufacturing - concept, sources of waste, benefits and applications,Factory of future (FOF)

Text Books:

1. Ibrahim Zeid and R. Sivasubramaniam, 2nd Edition, CAD/CAM – Theory and Practice, Tata

McGraw Hill, India, 2009

2. M. Groover and E. Zimmers, CAD/CAM: Computer Aided Design and Manufacturing, Pearson Education, 2007

Suggested Readings:

1. James A. Rehg, Henry W. Kraebber, "Computer Integrated Manufacturing", Pearson Education. 2007

2. Chennakesava R. Alavala, "CAD/CAM: Concepts and Applications", PHI Learning Pvt. Ltd.s

BEE034: Artificial Intelligence

Credits : 3

LTP 300

Course Description: The course aims to equip the students with a comprehensive study of the Artificial Intelligence.

The course includes basic decision-making algorithms, including search based and problem-solving techniques, and first-order logic.

Course Outcomes (CO):

CO1: Demonstrate fundamental understanding of artificial intelligence (AI).

CO2: Apply basic principles of AI in solutions that require problem solving, knowledge representation, and learning.

CO3: Attain the capability to represent various real-life problem domains.

CO4: Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search.

Course Content

Unit I

Overview of A.I: Introduction to AI, Importance of AI, Foundations of artificial intelligence, AI and its related field, AI techniques, Criteria for success.

Problems, problem space and search: Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem.

Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction.

Unit II

Knowledge representation: Definition and importance of knowledge, Knowledge presentation, various approaches used in knowledge representation, Issues in knowledge representation.

Using Predicate Logic: Representing Simple Facts in logic, representing instances and is-a relationship, Computable function and predicate.

Unit III

Natural language processing: Introduction syntactic processing, Semantic processing,

Discourse and pragmatic processing.

Learning: Introduction learning, Rote learning, learning by taking advice, learning in problem solving, learning from example-induction, Explanation based learning.

Unit IV

Pattern Recognition: Recognition and Classification Process-Decision Theoretic Classification, Syntactic Classification; Learning Classification Patterns, Recognizing and Understanding Speech.

Expert System: Introduction, Representing using domain specific knowledge, Expert system shells. LISP and other AI Programming Language.

Recommended Books / Suggested Readings:

1. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1999.
2. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1999.
3. Nils J Nilsson, "Artificial Intelligence-A new Synthesis" 2nd Edition (2000), Harcourt Asia Ltd

BRE749: Machine Learning

Credits : 3

LTP 300

Course Description: The course aims to equip the students to design and analyses various machine learning algorithms and technique.The course introduces supervised and unsupervised learning paradigms of machine learning.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe machine learning concepts and range of problems that can be handled by machine learning.

CO2: Recall the concept of clustering.

CO3: Differentiate supervised and unsupervised learning.

CO4: Describe the concept of Reinforcement learning.

Course Content

Unit I

Overview: foundations, scope, problems, and approaches of Intelligent agents: reactive, deliberative, goal-driven, utility-driven, learning agents, Artificial Intelligence programming techniques. **Problem-solving through Search:** forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications

Unit II

Introduction: Machine Learning, Characteristics of modern Machine Learning, why use Machine learning, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Machine Learning Process Flow. **Supervised Learning:** Supervised learning, types of supervised learning: classification, Regression. Basic Methods: Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression. Support Vector Machines, Illustration how Support Vector Machine works, Implementation of Support Vector Machine for Classification.

Unit III

Unsupervised Learning: Clustering, K-means Clustering, how does K-means algorithm work,

C-means Clustering, Hierarchical Clustering, How Hierarchical Clustering works.

Unit IV

Reinforcement learning: Reinforcement Learning, Elements of Reinforcement Learning, Epsilon Greedy Algorithm, Markov Decision Process (MDP).

Recommended Books / Suggested Readings:

1. Machine Learning by Tom M. Mitchell. 2014 Reprint. McGraw-Hill Science.
2. Reinforcement Learning: An Introduction by Richard S Sutton and Andrew G. Barto. (2016). MIT Press.
3. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz (2015).
4. Simpler: Using Machine Learning Algorithms in R by Darrin Thomas (2017).
5. Introduction to Machine Learning by Ethem Alpaydin. PHI Publisher.
6. Machine Learning, A practical approach on the statistical leaarning theory by Rodrigo fernandes de Mello and Moacir Antonelli Ponti.
7. Machine Learning A probabilistic prospective by Kevin P. Murphy.

BEE036: Internet of Things

Credits : 3

LTP 300

Course Description: The course aims to make the students familiar with trending technology of IoT.

The course includes IoT Architectural Overview, Elements of IoT Hardware Components, IoT Application Development Solution framework for IoT applications.

Course Outcomes (CO):

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

CO1: Describe the internet of Things and its hardware and software components.

CO2: Describe the Interface I/O devices, sensors & communication modules.

CO3: Discuss the remotely monitor data and control devices.

CO4: Develop real life IoT based projects.

Course Contents

Unit I

Introduction to IoT Architectural Overview: Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

Unit II

Elements of IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python /Node.js /Arduino) for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Unit III

IoT Application Development Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices. .

Unit IV

IoT Case Studies IoT case studies and mini projects based on Industrial automation,

Transportation, Agriculture, Healthcare, Home Automation.

List of suggested books:

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, “A Hands-on Approach”, University Press

2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs

3.Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press

4. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi

5. Adrian McEwen, “Designing the Internet of Things”, Wiley

6. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill 7.

7. Cuno Pfister, “Getting Started with the Internet of Things”, O Reilly Media.

BRE724: Artificial Intelligence Laboratory

Credits : 1

LTP 002

Course Description: The course aims to equip the students with a comprehensive study of the Artificial Intelligence. The course includes basic decision-making algorithms, including search based and problem-solving techniques, and first-order logic.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Develop simple applications using AI tools.

CO2: Attain the capability to represent various real-life problem domains using logic-based technique and use this to perform inference or planning.

CO3: Demonstrate fundamental understanding of the evaluation of Artificial Intelligence (AI) and its foundations.

CO4: Apply basic principles of AI in solutions that require problem solving, perception, knowledge representation, and learning.

Lab Exercises:

1. Write a python program to print the multiplication table for the given number.
2. Write a python program to check whether the given number is prime or not.
3. Write a python program to find factorial of the given number.
4. Write a python program to implement simple Chatbot.
5. Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing).
6. Write a python program to implement List methods (Add, Append, Extend & Delete).
7. Write a python program to Illustrate Different Set Operations.
8. Write a python program to generate Calendar for the given month and year.
9. Write a python program to implement Simple Calculator program.
10. Write a python program to Add Two Matrices.
11. Write a python program to Transpose a Matrix.
12. Write a python program to implement Breadth First Search Traversal.
13. Write a python program to implement Water Jug Problem.

14. Write a python program to remove punctuations from the given string.
15. Write a python program to sort the sentence in alphabetical order.
16. Write a program to implement Hangman game using python.
17. Write a program to implement Tic-Tac-Toe game using python.

BRE725: Machine Learning Laboratory

Credits : 2

LTP 004

Course Description: The course aims to understand the concepts of Machine concepts using Python. The course includes techniques of machine learning using python.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the List, Tuples and Dictionaries in Python.

CO2: Express different Decision-Making statements and Functions.

CO3: Interpret Object oriented programming in Python

CO4: Summarize different File handling operation.

CO5: Design and develop Machine learning techniques using Python.

Lab Exercises:

1. Python Programs based on Operators and Expressions.
2. Python Programs based on if and else if statements.
3. Python Programs based on loops.
4. Python Programs based on Sequences and File Operations.
5. Python Programs based on Working with Files.
6. Python Programs based on Errors and Exception Handling.
7. Python Programs based on Dictionaries and Sets.
8. Python Programs based on Using Modules.
9. Python Programs based on Regular Expressions.
10. Python Programs based on Object Oriented Programming.
11. Projects uses various Machine learning techniques:

a) Social Media Sentiment Analysis.

b) Sales Forecasting.

c) Weather Prediction.

d) Diabetes Prediction.

e) Smart attendance System (Face recognition).

f) Text to speech.

BRE726: Internet of Things Laboratory

Credits : 1

LTP 002

Course Description: : The course aims to make the students familiar with trending technology of IoT.

Course Outcomes (CO):

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

CO1: List out the different IOT applications and importance of IOT.

CO2: Describe the Arduino platform and programming.

CO3: Describe data and control devices.

CO4: Develop real life IoT based projects.

Lab Exercises:

1. Introduction to Arduino platform and programming
2. Introduction to the electrical and electronic component.
3. Introduction to the sensors.
4. Blink the LED on Pin 13
5. Build a circuit with an external LED
6. The Potentiometer
7. The Pushbutton
8. Procedures to Reuse Code
9. Design an IOT based system

BRE726: Internet of Things Laboratory

Credits : 1

LTP 002

Course Description: The course aims to make the students familiar with trending technology of IoT.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: List out the different IOT applications and importance of IOT.

CO2: Describe the Arduino platform and programming.

CO3: Describe data and control devices.

CO4: Develop real life IoT based projects.

Lab Exercises:

1. Introduction to Arduino platform and programming
2. Introduction to the electrical and electronic component.
3. Introduction to the sensors.
4. Blink the LED on Pin 13
5. Build a circuit with an external LED
6. The Potentiometer
7. The Pushbutton
8. Procedures to Reuse Code
9. Design an IOT based system

HRM001: HUMAN RESOURCE MANAGEMENT

Credits : 3

LTP 300

Course Description:

1. To know the importance of human resource management as a field of study and as a central management function;
2. To understand the implications for human resource management of the behavioral sciences, government regulations, and court decisions;
3. To know the elements of the HR function (e.g. – recruitment, selection, training and development, etc.) and be familiar with each element's key concepts & terminology; and

Course Outcomes (CO):

1. Apply the principles and techniques of human resource management gained through this course to the discussion of major personnel issues and the solution of typical case problems.
2. Identify each of the major HRM functions and processes of strategic HRM planning, job analysis and design, recruitment, selection, training and development, compensation and benefits, and performance appraisal
3. Define strategic HR planning and the HRM process to the organization's strategic management and decisionmaking process
4. Recall the wide range of sources for attracting and recruiting talent and appropriate practices for job placement
5. Recognize emerging trends, opportunities and challenges in performance appraisal
6. List training and development processes as well as future trends for HRM globalization

Course Content

Unit I

Introduction to Human Resource Management: The focus of the first unit is on identifying what the personnel and human resource function is all about. It explores the typical responsibilities of HR departments and how they are affected by the corporate culture, environmental forces, and government regulations. It also introduces the topics of strategic and employment planning.

Staffing: Once the organization has determined its strategic and human resource objectives and analyzes the jobs to be filled, it is ready to fill them. Unit 2 reviews the two steps in the staffing process: recruitment and selection. Recruitment aims at identifying and attracting the largest possible number of qualified applicants to hire for each job.

Unit II

Compensation & Benefit: This unit focuses on compensation and related issues. Among the topics to be covered are forms of and bases for compensation, job evaluation and compensation/evaluation systems.

Performance Management: This unit discusses and examines performance evaluation as a system including process and procedures used in developing reliable and valid standards, criteria, and evaluation mechanisms. A good performance management system is fair to the employee while also serving the goals and interests of the organization.

Unit III

Human Resource Development: Employee training and development is another important HR function. More specifically, Unit 5 focuses on deciding who is to be trained, in what and how they are to be trained, and how effective was the training for the employee and her/his organizational component. To be effective, training and development programs must be matched to types of employees with specific skill deficiencies and to new skills anticipated to be needed by the organization.

Unit IV

Global Human Resource Management & Future Issues: Declining productivity, substantial demographic shifts, changing employee attitudes and expectations, innovation technologies, and government regulations will continue to affect human resource management into the 21st century. This final unit deals with the most significant trends in human resource management and how they can be addressed through innovative and effective organizational strategies.

Text Books:

1. Dessler, G. Fundamentals of Human Resource Management (4th Edition, Pearson)ISBN:9780133791532
2. Human Resource Management by Caroyln Youssef

Suggested Readings:

1. Human Resource Management by Manmohan Joshi
2. Human Resources: A Practical Guide by Gemma Reucroft , Tim Scott

TQM001: TOTAL QUALITY MANAGEMENT

Credits : 3

LTP 300

Course Description: To understand Quality in Manufacturing, Service, Health care and Education

1. To know the importance of commitment and involvement of leadership and management in TQM implementation
2. To understand the application and processes of The various Quality Awards

Course Outcomes (CO):

1. Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
2. Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality.
3. Critically appraise the organizational, communication and teamwork requirements for effective quality management
4. Critically analyze the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans

Course Contents

Unit I

Quality and Total Quality Management: Excellence in manufacturing/service, factors of excellence, relevance of TQM.

Concept and definition of quality: Total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.

Unit II

Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

Customer: Satisfaction, data collection and complaint, redressal mechanism.

Unit III

Planning Process: Policy development and implementation; plan formulation and implementation.

Process Management: Factors affecting process management, Quality function development (QFD), and quality assurance system.

Unit IV

Total Employees Involvement (TEI): Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.

Problems solving: Defining problem, Problem identification and solving process, QC tools.

Benchmarking: Definition, concept, process and types of benchmarking.

Text Books:

1. Sunder Raju, Total Quality Management , Tata McGraw Hill.
2. M.Zairi, TQM for engineers, Aditya Books.

Suggested Readings:

1. J.L. Hradeskym, Total Quality Management Handbook, McGraw Hill.
2. Dalela and Saurabh, ISO 9000 quality System, Standard Publishers.

HBW001: HUMAN BEHAVIOR AT WORK

Credits : 3

LTP 300

Course Description: Human Resources Specialists need a fundamental understanding of the interactions that occur among people in the workplace. This Social Science course provides the student with the tools to understand and evaluate individual, group and organizational processes. The student will also gain an appreciation of the relevance of the study of organizational behavior to the practice of human resource management.

Course Outcomes (CO):

1. Analyze individual and group behaviour, and understand the implications of organizational behavior on the process of management.
2. Identify different motivational theories and evaluate motivational strategies used in a variety of organizational settings.
3. Evaluate the appropriateness of various leadership styles and conflict management strategies used in organizations.
4. Describe and assess the basic design elements of organizational structure and evaluate their impact on employees.
5. Explain how organizational change and culture affect working relationships within organizations.

Course Contents

Unit I

Organizational Behavior: What managers do, Definition of OB, contributing disciplines to OB, challenges and opportunities for OB. Foundations of Individual behavior- biographical characteristics, ability, and learning. Values, Attitudes Personality and Emotions Perception.

Unit II

Motivation: Concept, Theories of Maslow , Herzberg, McClelland, Porter & Lawler Model, Application of Motivation Concept. Job Satisfaction Foundations of Group Behavior: Group formation, development and structure, Group Processes, Group Decision- making Techniques, Work Teams.

Unit III

Interpersonal Skill- Transactional analysis, Life Positions, Johari Window. Leadership: Concept, theories styles and their application. Power and Politics in Organization

Unit IV

Conflict Management, Stress Management, Crisis Management Organizational Change & Development, Innovation, Creating a learning Organization Organizational Culture Organizational Effectiveness.

Text Books:

1. Robbins Organization Behaviour Pearson Educationa Asia
2. Luthans Organization Behaviour Tata McGraw Hill
3. Udai Pareek Understanding Origination Oxford Publishing House

Suggested Readings:

1. Hersey, Management of Organizational Prentice Hall India Blanachard Behaviour & Johnson
2. Newstrom Organizational Behaviour: Human Tata McGraw Hill & Davis Behaviour at Work
3. Rallinson, OB & Analysis Addison Wasley Broadfield & Edwards

INP001: INDUSTRIAL PSYCHOLOGY

Credits : 3

LTP 300

Course Description:

1. To introduce the concepts, tools, and techniques of industrial engineering
2.To introduce control charts, acceptance sampling, concepts of line balancing, work measurement, and production management etc.
3. To enable the students to develop knowledge and skills in using and integrating these tools.

Course Outcomes (CO):

1. To analyze lacunae in existing layout of a shop floor in manufacturing and service organizations and develop an improved plant layout.
2. To apply quality engineering tools for process control and improvement.
3. To develop a production schedule using information/ data from different functional areas. To determine

Course Contents

Unit I

Introduction: Introduction to industrial engineering, significance of system's approach in applying industrial engineering in the industry.

Productivity Management: Productivity measurement and improvement, resource waste minimization

Unit II

Plant Location & Layout: Factors affecting plant location, Selection of plant site, Quantitative techniques of plant location decision, Plant layout, Principles of layout design, Evaluation of a layout, Line balancing technique for product layout.

Quality Engineering: Variation and its types, essential dimensions of quality, seven quality tools, quality system economics, statistical quality control, applications of control charts for variables and attributes, process capability analysis, introduction to six sigma, acceptance sampling.

Unit III

Production/ Operations Management: Demand forecasting, aggregate planning, master

production scheduling, type of inventories, inventory costs, inventory control models, EOQ (under deterministic conditions), ERL, materials requirements planning, JIT, SMED, kaizen, poka-yoke.

Work Study: Purpose and scope, method study and work measurement, principles of motion economy, principle of work sampling, MOST etc.

Unit IV

Ergonomics: Role of ergonomics in industry, introduction to anthropometry, posture analysis, effect of physical environment on performance.

Text Books:

1. Monks, J. G., Production/Operations Management, McGraw Hill (2004).
2. Shankar, R., Industrial Engineering and Management, Galgotia Publications (2012).

Suggested Readings:

1. Grant, E.L., Statistical Quality Control, McGraw Hill (2008).
2. Sanders, M. and McCormick, E., Human factors in Engineering, McGraw Hill (1993).
3. Montegomery, D.C., Introduction to Statistical Quality Control, Wiley (2005).