ORDINANCE

FOR

B.TECH. MECHANICAL 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. MECHANICAL AND AUTOMATION ENGINEERING

SHORT TITLE AND COMMENCEMENT

I. This Ordinance shall be called the Ordinance for the B.Tech. Mechanical 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. Mechanical 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 engineering problems 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.

IX) 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.

4. Program Specific Outcomes:

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

I. Apply their knowledge to the domain of thermal, solid mechanics, mechanics of machines and fluid mechanics and to solve the engineering problems arising out of these areas.

II. Analyze and provide a solution to real life problems related to mechanical engineering fields together with the allied engineering branches.

III. 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.

IV. Provide the solution to automate the various manual processes for the industry and identify the various components required for it.

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 upto 10% 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.

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	BEE301	Electronic Devices	3	0	0	40	60	100	3
3.	PCC	BMA301	Thermodynamics	3	1	0	40	60	100	4
4.	PCC	BMA302	Computer Aided Design-I	3	0	0	40	60	100	3
5.	PCC	BMA303	Strength of Material	3	1	0	40	60	100	4
6.	LC	BEE321	Electronic Devices Laboratory	0	0	2	30	20	50	1
7.	LC	BMA321	Thermodynamics Laboratory	0	0	2	30	20	50	1
8.	LC	BMA322	Computer Aided Design-I Laboratory	0	0	4	60	40	100	2
9.	LC	BMA323	Strength of Material Laboratory	0	0	2	30	20	50	1
10.	PROJ	BMA300	Summer Training*	0	0	20	60	40	100	4
Total							**410**	**440**	**850**	**24**

***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	BME401	Material Engineering	3	0	0	40	60	100	3
2.	PCC	BMA403	Computer Aided Design-II	3	0	0	40	60	100	3
3.	PCC	BMA404	Kinematics and Dynamics of Machines	3	1	0	40	60	100	4
4.	PCC	BMA405	Manufacturing Processes	3	0	0	40	60	100	3
5.	PCC	BMA406	Fluid Mechanics	3	1	0	40	60	100	4
6.	LC	BME421	Material Engineering Laboratory	0	0	2	30	20	50	1
7.	LC	BMA423	Computer Aided Design-II Laboratory	0	0	4	60	40	100	2
8.	LC	BMA434	Kinematics and Dynamics of Machines Laboratory	0	0	2	30	20	50	1
9.	LC	BMA435	Manufacturing Processes Laboratory	0	0	2	30	20	50	1
10.	LC	BMA426	Fluid Mechanics Laboratory	0	0	2	30	20	50	1
Total							**380**	**420**	**800**	**23**

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	BMA503	IC Engines	3	1	0	40	60	100	4
2.	PCC	BMA504	Computer Aided Design-III	3	0	0	40	60	100	3
3.	PCC	BMA509	CNC Technology	2	0	0	40	60	100	2
4.	PCC	BMA506	Metrology and Quality Control	3	0	0	40	60	100	3
5.	PCC	BMA507	Industrial Automation	3	0	0	40	60	100	3
6.	PEC		Elective-I	3	0	0	40	60	100	3
7.	LC	BMA523	IC Engines Laboratory	0	0	2	30	20	50	1
8.	LC	BMA524	Computer Aided Design-III Laboratory	0	0	4	60	40	100	2
9.	LC	BMA529	CNC Technology Laboratory	0	0	2	30	20	50	1
10.	LC	BMA536	Metrology and Quality Control Laboratory	0	0	2	30	20	50	1
11.	LC	BMA537	Industrial Automation Laboratory	0	0	2	30	20	50	1
12.	PROJ	BMA500	Software/ Industrial Training*	0	0	20	60	40	100	2
						Total	**520**	**520**	**1040**	**26**

***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 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	BMA604	Refrigeration and Air Conditioning	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	BMA624	Refrigeration and Air Conditioning Laboratory	0	0	2	30	20	50	1
10.	MC	BMC003	Essence of Indian Traditional Knowledge	2	0	0	40	0	0	0
						Total	**360**	**440**	**800**	**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	BMA701	Computer Aided Engineering	3	1	0	40	60	100	4
2.	PCC	BMA703	Computer Aided Manufacturing	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	BMA700	Major Project	0	0	4	60	40	100	2
6.	LC	BMA721	Computer Aided Engineering Laboratory	0	0	4	60	40	100	2
7.	LC	BMA723	Computer Aided Manufacturing Laboratory	0	0	4	60	40	100	2
						Total	**340**	**360**	**700**	**19**

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	BMA800	Industrial Training	0	0	0	150	250	400	10
2.	PROJ	BMA801	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.	PCC	BMA545	Mechatronics	3	0	0	3	3
2.	PEC	BMA547	Composite Materials	3	0	0	3	3
3.	PEC	BMA550	Process Planning and Cost Estimation	3	0	0	3	3
4.	PEC	BMA549	Maintenance Engineering	3	0	0	3	3
Elective-II (Semester-VI)								
1.	PEC	BMA645	Non-Destructive Testing	3	0	0	3	3
2.	PEC	BMA646	Operations Research	3	0	0	3	3
3.	PEC	BMA647	Tribology	3	0	0	3	3
4.	PEC	BMA648	Product Lifecycle Management	3	0	0	3	3
Elective-III (Semester-VII)								
1.	PEC	BMA741	Non – Traditional Machining	3	0	0	3	3
2.	PEC	BMA742	Industrial Safety	3	0	0	3	3
3.	PEC	BMA743	PLC Programming	3	0	0	3	3
4.	PEC	BMA744	Industrial Engineering	3	0	0	3	3

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	BEE034	Artificial Intelligence	3	0	0	3
19	BEE035	PLC and SCADA	3	0	0	3
20	BEE036	Internet of Things	3	0	0	3
21	BEE037	Biomedical Instrumentation	3	0	0	3
22	BEE038	Nano-Electronics	3	0	0	3
23	BAE031	Basics of Aerospace Engineering	3	0	0	3

24	BAE032	Basics of Aircraft Materials	3	0	0	3
25	QMD031	Quantitative methods for decision making	3	0	0	3
26	VAE031	Values and Ethics	3	0	0	3
27	EPI031	Economic Policies in India	3	0	0	3
28	FME031	Fundamentals of Management for Engineers	3	0	0	3
29	BCS041	Basics of Python Programming	2	0	2	3
30	BCS042	Introduction to Linux and Shell Programming	2	0	2	3
31	BCS043	Basics of Web Technologies	2	0	2	3
32	BCE031	Water pollution and its management	2	0	2	3
33	BCE032	Global warming and Climate Change	3	0	0	3
34	BCE033	Disaster Management and Mitigation	3	0	0	3
35	BCE034	Soil Chemistry and its impact	3	0	0	3
36	BCE035	Energy engineering technological and management	3	0	0	3
37	BCE036	Renewable energy technology	3	0	0	3
38	BCE037	Industrial pollution prevention and control	3	0	0	3
39	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						**21**
2.	ESC	6	7	3	3					**19**
3.	PCC			11	14	15	9	7		**56**
4.	PEC					3	3	3		**9**
5.	HUMANITIES	2	2				3			**7**
6.	OE						3	3		**6**
7.	LC	5	5	5	6	6	4	4		**35**
8.	PROJECT					2		2	15	**19**
	Total	**21**	**22**	**24**	**23**	**26**	**22**	**19**	**15**	**172**

List of Courses for B. Tech Mechanical and Automation Engineering (Honors)

S. No.	Course Code	Course Title	Semester	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1.	BMA304	Ergonomics	III	3	0	0	3	3
2.	BMA406	Internet of Things	IV	3	0	0	3	3
3.	BMA426	Internet of Things Laboratory	IV	0	0	2	1	1
4.	BMA508	Product Design and Development	V	3	0	0	3	3
5.	BMA528	Product Design and Development	V	0	0	2	1	1
6.	BMA605	Artificial Intelligence	VI	3	0	0	3	3
7.	BMA625	Artificial Intelligence Laboratory	VI	0	0	2	1	1
8.	BMA704	Computational Fluid Dynamics	VII	3	0	0	3	3
9.	BMA704	Computational Fluid Dynamics Laboratory	VII	0	0	2	1	1

B.Tech. Mechanical and Automation Engineering with Minor Degree in Robotics

S. No.	Semester	Course Title	Course Code	L	T	P	Credit	Contact Hrs
1.	3rd	Basics of Python	BCS209	3	0	0	3	3
2.	3rd	Python Laboratory	BEE299	0	0	2	1	2
3.	4th	Digital Electronics and Applications	BEE305	3	0	0	3	3
4.	4th	Digital Electronics and Applications Laboratory	BEE325	0	0	2	1	2
5.	5th	Robot Kinematics and Dynamics	BRE504	3	0	0	3	3
6.	5th	Robot Kinematics and Dynamics Laboratory	BRE524	0	0	2	1	2
7.	6th	Product Lifecycle Management	BRE601	3	0	0	3	3
8.	6th	Product Lifecycle Management Laboratory	BRE621	0	0	2	1	2
9.	7th	PLC Programming	BRE703	3	0	0	3	3
10.	7th	PLC Programming Laboratory	BRE723	0	0	2	1	2
Total Credits								**25**

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.

16.1 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 the 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 172. If any student fails to earn prescribed credits 172 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
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B.TECH. MECHANICAL 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/
9. 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: Develop better understanding of nuances of English language through audio- visual experience and group activities

CO2: Hone speaking skills with clarity and confidence

Course Content

Unit I

Daily Discourse: Common Everyday Situations: Conversations and Dialogues (Unit 1-6), Monologue (2D/4D/5D/6D), and Communication at workplace

Unit II

Listening Skills: 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)

Unit III

Phonetic Skills: Pronunciation, Intonation, Stress (Unit 1-6) and Rhythm

Unit IV

Speaking Skills: Group Discussion / Debate, Role Plays

ENS001: Environmental Studies

Credits : 2

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.

Unit II

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 III

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.

Unit IV

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 V

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.

Unit VI

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 VII

Human Communities and the Environment: Human population and growth: Impact 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, Bishnios 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).

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 Treatement. 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. 21.www.nacwc.nic.in
22. 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. The course includes projection of solids, sectioning of solids, development of surfaces, isometric projection and AutoCAD – 3D modeling and editing.

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

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.

BEE301: 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, the students 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 Contents:

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

BMA301: THERMODYNAMICS

Credits : 4

LTP 310

Course Description: This course deals with the fundamentals of Thermodynamics including thermodynamic systems and properties, the laws of thermodynamics and applications of these basic laws in thermodynamic systems. In addition course aims to recognize and understand the concepts and working of various SFE devices involved in power generation systems using steam as a working substance.

Course Outcomes (CO): Students will be able

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

1. To draw and analyze various vapor power cycles and solve related problems by application of steam table / Mollier Chart
2. To identify and select different types of boilers for various commercial applications.
3. To suggest and design different parameters of steam turbines/nozzles for various industrial applications.
4. To evaluate the performance characteristics of a reciprocating air compressor.

Unit I

Introduction to Thermodynamics: Definition, thermodynamics systems, pure substances, properties of system, Zeroth law of thermodynamics, laws of thermodynamics.

Steam Properties: Steam formation, properties of steam, phase change and its representation on PV and TS diagrams, dryness fraction and its calculation, steam tables and Mollier diagram.

Working Cycles: Carnot cycle and its limitations, Rankine cycle, methods of improving Rankine efficiency - feed water heating (bleeding), reheat cycle, combined reheat and regenerative cycle, ideal working fluid – Binary vapor cycle, combined power and heating cycles, introduction to steam engine with brief discussion

Unit II

Steam Generators: Review of steam generation process, classification of fire and water tube boilers, description of Cochran, Locomotive, Lancashire, Babcock and Wilcox boilers and Sterling boilers, boiler mountings and accessories etc., modern high pressure boilers,

characteristics of high pressure boilers, advantages of forced circulation, steam accumulators, boiler performance, equivalent evaporation, boiler efficiency, Boiler Trial.

Steam Nozzle: Types of nozzles and their utility flow of steam through nozzles, critical pressure and discharge, area of throat and exit for maximum discharge, effect of friction on nozzle efficiency, supersaturated flow.

Unit III

Steam Turbines: Classification-impulse & reaction steam turbines, description of components, pressure and velocity compounding, velocity diagram and work done, effect of blade friction on velocity diagram, stage efficiency and overall efficiency, reheat factor and condition curve, degree of reaction, blade efficiency and its derivation, calculation of blade height, backpressure and extraction turbines and cogeneration, Economic assessment, method of attachment of blades to turbine rotor, losses in steam turbines, governing of steam turbines, labyrinth packing.

Unit IV

Reciprocating Air Compressors: Use of compressed air in industry, classification of air compressors, operation of single stage reciprocating compressors, work input and the best value of index of compression, isothermal and polytrophic efficiency, effect of clearance and volumetric efficiency, multistage compression and its advantages, optimal multistage, work input in multistage compression.

Textbooks:

1. P.K Nag, “Engineering Thermodynamics”, Tata McGraw Hill, New Delhi.
2. D.S. Kumar and V.P. Vasandani, “Heat Engineering”, Metropolitan Book Co. Pvt. Ltd.
3. R.K Rajput, Thermal Engineering, Laxmi Publication Pvt. Ltd., New Delhi.
4. G. Rogers and Y. Mayhew, “Engineering Thermodynamics”, Pearson Eduction.

Suggested Readings:

1. Shapiro A. M, “Dynamics and Thermodynamics of Compressible Fluids”, Ronald's Press, New York (1953).
2. Benson R W, “Advanced Engineering Thermodynamics”, Pergamon Press, London (1975).
3. W.A.J. Keartan, Steam Turbine: Theory and Practice, ELBS Series.
4. T D Eastop and A McConkey, “Applied Thermodynamics for Engineering Technologists” Pearson Education
5. R. Yadav, “Applied Thermodynamics”, Central Publishing House.
6. J.S. Rajadurai, Thermodynamics and Thermal Engineering, New Age International (P) Ltd. Publishers.
7. K. Soman, “Thermal Engineering”, PHI Learning Pvt. Ltd.

Web Links:

1. http://nptel.ac.in/courses/112104117/22
2. https://www.ikbooks.com/home/samplechapter?filename=38_Sample_Chapter.pdf
3. http://www.nkpatel.co.in/Old%20course/US04CICV01/Unit%206%20Boiler.pdf
4. https://www.dol.ks.gov/Registration/Handouts2015/BoilerBasics-JasonFunk-ShConf2015.pdf
5. http://www.thermodynamicsheatengines.com/HeatEnginesVol%202%20Chapter%208%20RS.pdf
6. https://www.scribd.com/document/326239755/Unit-3-Steam-Nozzles

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 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.

BMA321: THERMODYNAMICS LABORATORY

Credits : 1

LTP 002

Course Description: Course aims to provide basic understanding of steam generation process, operation of identified boilers, boiler mountings and accessories. It also provides students with practical exposure to the operation and performance of reciprocating compressors widely used in mechanical industry

Course Outcomes (CO): Students will be able

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

CO1: Calculate dryness fraction of steam experimentally.

CO2: Demonstrate comprehension of construction, operation and performance of specific types of boilers, their mountings and accessories

CO3: Demonstrate comprehension of construction and operation of specific types of steam condensers and cooling towers.

CO4: Calculate experimentally the efficiency of reciprocating / centrifugal compressor.

Course Content:

List of experiments:

1. Study of working, construction, mountings and accessories of various types of boilers.
2. Study of working and construction of Fire tube boilers (Lancashire, Locomotive & Cochran Boiler)
3. Study of working and construction of Water tube boilers (Sterling and Babcock & Wilcox Boiler).
4. To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water-tube boiler.
5. Determination of dryness fraction of steam by using separating and throttling calorimeter.
6. Study of construction and operation of various types of steam condensers and cooling towers.
7. To study the effect of forward curved, backward curved and radial vanes in a centrifugal compressor and to find out the overall efficiency of the compressor.

8. To determine the volumetric and isothermal efficiency of two stage air compressor.

Suggested Readings:

1. Shapiro A. M, "Dynamics and Thermodynamics of Compressible Fluids", Ronald's Press, New York (1953).
2. Benson R W, "Advanced Engineering Thermodynamics", Pergamon Press, London (1975).
3. W.A.J. Keartan, Steam Turbine: Theory and Practice, ELBS Series.
4. T D Eastop and A McConkey, "Applied Thermodynamics for Engineering Technologists" Pearson Education
5. R. Yadav, "Applied Thermodynamics", Central Publishing House.
6. J.S. Rajadurai, Thermodynamics and Thermal Engineering, New Age International (P) Ltd. Publishers.
7. K. Soman, "Thermal Engineering", PHI Learning Pvt. Ltd.

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): Students will be able

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 Content:

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.

BME401: MATERIAL ENGINEERING

Credits : 3

LTP 300

Course Description: The purpose of this course is to provide a general background of the field of materials science and engineering for graduate level students. Fundamental topics such as chemical bonding in materials, crystal structure and defects, diffusion, and phase diagrams will be introduced. Then the mechanical, electrical and optical properties of materials will be covered and information of types of materials and their applications be provided. This course covers different material systems such as metal, ceramics, polymer materials and offers examples of materials application in microelectronics and other technology fields.

Course Outcomes (CO):

CO1: Know basics of crystallography and its importance for varied materials properties.

CO2: Understand the properties of materials through the study of phase relationships.

CO3: Gain knowledge on the electrical and magnetic properties of materials and their applications.

CO4: Understand the relations between the composition, temperature and phase fractions applied to equilibrium phase diagrams for given material systems.

CO5: Understand the optical properties of materials and working principles of various optical devices.

Course Contents:

Unit I

Mechanical properties and behavior of materials: Elastic and plastic behavior of metals and polymers- imperfections in crystals, mechanism of plastic deformation, deformation of single crystal by slip, stress-strain curve, yield point phenomenon, mechanical properties of materials.

Unit II

SMaterial testing and fracture behavior: Fracture- types of fracture and Griffith theory, fatigue and fatigue testing, impact testing, creep, creep mechanism and creep testing, hardness testing, Brinell and Rockwell hardness testing, failure analysis.

Phase diagrams: Constitution of alloys – solid solutions, substitutional and interstitial, phase diagrams- isomorphous, eutectoid, eutectic, peritectic and peritectoid reactions, iron-carbon diagram, classification of steel and cast iron- microstructure, properties and applications.

Unit III

Non metallic materials and modern materials: Polymeric materials – formation of polymer structure, production techniques, composites – types, applications and production techniques, ceramics – types and applications, dual phase alloys, micro alloyed steels, High Strength Low Alloy (HSLA) steel, Transformation Induced Plasticity (TRIP) and nano crystalline materials.

Unit IV

Strengthening mechanisms and non-destructive testing: Refinement of grain size, work hardening, solid solution –strengthening, dispersion strengthening, precipitation hardening, magnetic particle inspection, dye penetrant inspection, ultrasonic inspection, radiography, eddy-current testing, acoustic emission inspection

Recommended Books / Suggested Readings:

1. Kenneth G Budinski and Michael K .Budinski, “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint, 2002.
2. William D Callister, “Material Science and Engineering”, John Wiley and Sons, 2007.
3. V Raghavan, “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 2007.
4. Sydney H. Avner, “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 2007.
5. G.E Dieter, “Mechanical Metallurgy”, McGraw Hill Book Company, 1988.
6. O.P Khanna., “A text book of Materials Science and Metallurgy”, Khanna Publishers, 2003.
7. M.S Vijaya. and G Rangarajan, “Material Science”, Tata McGraw-Hill, 2007.
8. V.D. Kodgire and S.V Kodgire., “Material science and Metallurgy for Engineers”, Everest Publishing House, Pune, 24th Edition, 2008.
9. Barry Hull and Vernon John, “Non destructive testing” MacMillon, 1988.
10. G.E Dieter, “Mechanical Metallurgy”, McGraw Hill, 2001.

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:

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 softwares The 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.

Recommended Books / 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 the transmission 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

Web Links:

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

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:

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.

Web Links:

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

BMA406: FLUID MECHANICS

Credits : 4

LTP 310

Course Description: This course aims to develop an understanding of the behavior of fluids at rest or in motion. It also enables the student to apply the fluid mechanics concepts for the designing of fluid machines using dimensional analysis and similitude. In addition this course enables them to understand the subsequent effects of the fluids flowing through pipes and other measuring devices and equipment.

Course Outcomes (CO):

CO1: Identify and obtain the values of fluid properties and relationship between them.

CO2: Measure various parameters such as pressure, velocity, flow rate using different devices/instruments

CO3: Compute and analyze hydrostatic/buoyant forces on submerged bodies.

CO4: Apply mass/momentum/energy conservation & dimensional analysis/similitude concepts to solve fluid mechanics problems

CO5: Apply appropriate equations and principles to analyze pipe flow problems.

Course Contents:

Unit I

Fundamentals of Fluid Mechanics: The concept of a fluid, the fluid as a continuum, properties of fluid, thermodynamic properties of a fluid, viscosity- dynamic and kinematic, density, specific weight, specific gravity, surface tension, capillarity, compressibility and bulk modulus, Discharge & its measurement: Notches (rectangular, V and Trapezoidal) and weirs, Rota meters. Pressure and its measurement: Barometer, peizometer & Manometers

Unit II

Fluid Statics: Pascal law and its applications, hydrostatic pressure distributions, manometer, hydrostatic forces on plane surfaces (vertical, horizontal and inclined), hydrostatic forces on curved surfaces, hydrostatic forces in Layered Fluids, buoyancy and stability, pressure distribution in rigid-body motion.

Fluid Kinematics: Classification of fluid flows; Lagrangian and Euler flow descriptions, velocity and acceleration of fluid particle, local and convective acceleration, normal and

tangential acceleration, path line, streak line, streamline and timelines, flow rate and discharge mean velocity, one dimensional continuity equation, continuity equation in Cartesian (x, y, z), polar (r, θ) and cylindrical (r, θ, z) coordinates, derivation of continuity equation using the Lagrangian method in Cartesian coordinates, rotational flows: rotation, vorticity and circulation, stream function and velocity potential function and relationship between them, flow net.

Unit III

Fluid Dynamics: Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline, derivation of Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows, pitot tubes, various hydraulic coefficients, orifice meters, venturimeters, Borda mouthpieces, representation of energy changes in fluid system (hydraulic and energy gradient lines), impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

Unit IV

Flow Through Pipes: Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes, Hagen – Poiseuille equation, Darcy equation, head losses in pipes and pipe fittings, flow through pipes in series and parallel, concept of equivalent pipe, roughness in pipes, Moody's chart.

Dimensional Analysis and Similarity: Dimension- fundamental and derived, units, dimension reasoning, dimensional quantities, construction of relationship by dimensional analysis using the indicial methods, dimensional analysis by group methods, significant of dimensionless numbers, geometric similarity, dynamic similarity, similarity applied to roto-dynamic machines.

Text Books:

1. F M White, “Fluid Mechanics”, McGraw Hill, New York.
2. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Fourteenth Edition, Standard Book House, 2002
3. D S Kumar ,“Fluid Mechanics and Fluid Power Engineering”, 6th Edition SK Kataria and Sons, Delhi (1998)
4. R K Bansal, “A text book of Fluid mechanics and Hydraulic Machines”, 8th Edition, Laxmi Publications (P) Ltd.New Delhi (2002)

Suggested Readings:

1. J F Douglas, Gasionckw, and J P Swaffield, “Fluid Mechanics”, 3rd Edition Addision Wesley Longman, Inc Pitman (1999)
2. Fox R.W. and McDonald A.T., "Introduction to Fluid Mechanics", Fifth Edition, John Wiley & Sons, Inc. 2001
3. Pao H F Richard, “Fluid Mechanics”, John Wiley and Sons (1995).
4. J A Fay, “Introduction to Fluid Mechanics”, Prentice Hall of India Private Limited, New Delhi (1996)
5. YunusCengel& John Cimbala, ”Fluid Mechanics: Fundamentals and Applications”, 2nd reprint 2007, Tata McGraw Hill, New Delhi
6. Som&Biswas, Fluid Mechanics, Tata-McGraw Hill, New York

Web Links:

1.https://vscht.cz/uchi/ped/hydroteplo/materialy/introduction.fluid.mech.pdf
2.http://nptel.ac.in/downloads/103104043/
3.http://varunkamboj.typepad.com/files/engineering-fluid-mechanics-1.pdf
4.https://www.scribd.com/document/172342403/Fluid-mechanics-by-R-K-Bansal-pdf
5.http://www.vssut.ac.in/lecture_notes/lecture1427495313.pdf
6.http://ybu.edu.tr/vlc/contents/files/938FM_3e_Chap01_lecture.ppt
7.http://ceeserver.cee.cornell.edu/mw24/cee331/lectures/00%20Introduction.ppt
8.http://www.rpi.edu/dept/phys/Courses/ppd1050/Lecture12.ppt

BME421: MATERIAL ENGINEERING LABORATORY

Credits : 1

LTP 002

Course Description: To understand the basic effect of heat treatment on the material and observe characteristics of different material.

Course Outcomes (CO):

At the end of the course the students can able to-:

CO1: Understand the basic structure atomic/crystal structure of metals.

CO2: To build up the basic concept of heat treatment

CO3: To get the knowledge about how to prepare a specimen for micro structural examination.

CO4: Comprehend the effect of corrosion on material

Course Contents:

List of Experiments:

1. Preparation of models/charts related to atomic/crystal structure of metals
2. To study heat treatment processes (hardening and tempering) of steel specimen.
3. Determination of hardenability of steel by Jominy End Quench Test.
4. Specimen preparation for micro structural examination – cutting, grinding, polishing, etching.
5. To study the mechanism of chemical corrosion and its protection.
6. To study the properties of various types of plastics.
7. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
8. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.

Recommended Books:

1. Kenneth G Budinski and Michael K .Budinski, “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint, 2002.
2. William D Callister, “Material Science and Engineering”, John Wiley and Sons, 2007.
3. V Raghavan, “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 2007.
4. Sydney H. Avner, “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 2007.
5. G.E Dieter, “Mechanical Metallurgy”, McGraw Hill Book Company, 1988.
6. O.P Khanna., “A text book of Materials Science and Metallurgy”, Khanna Publishers, 2003.

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: 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: 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):

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.

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 (CO):

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 Contents:

List of Experiments:

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.

BMA426: FLUID MECHANICS LABORATORY

Credits : 1

LTP 002

Course Description: This course intends to provide hands-on experience in verification of principles of fluid flow and to impart knowledge in measuring pressure, discharge and velocity of fluid flow. Moreover it helps to understand Major and Minor Losses in pipe flow.

Course Outcomes (CO):

At the completion of this course the student will be able to

CO1: Determine the Meta centric height of a ship mode.

CO2: Verify the Bernoulli's Theorem.

Co3: Determine the flow rate and coefficient of discharge using devices such as Venturimeter, orifice meter, v-notch and mouthpiece.

CO4: Determine minor losses and coefficient of friction in the pipes.

CO5: Determine the velocity distribution for pipe line flow with a pitot static probe.

List of Experiments:

1. To determine the met centric height of a ship model.
2. To verify Bernoulli's theorem.
3. To calibrate a venturimeter and to determine its coefficient of discharge.
4. To calibrate an orifice meter and to determine its coefficient of discharge.
5. To study the flow over rectangular- notch (weir) and to find the coefficient of discharge.
6. To study the flow over V- notch (weir) and to find the coefficient of discharge.
7. To determine the hydraulic coefficient of discharge of a mouth piece.
8. To determine the coefficient of friction of pipes of different diameters.
9. To determine the head loss in a pipe line due to sudden expansion / sudden contraction/ bend.
10. To determine the velocity distribution for pipe line flow with a pitot static probe.

Suggested Readings:

1. J F Douglas, Gasionckw, and J P Swaffield, "Fluid Mechanics", 3rd Edition Addision Wesley Longman, Inc Pitman (1999)

2. Fox R.W. and McDonald A.T., "Introduction to Fluid Mechanics", Fifth Edition, John Wiley & Sons, Inc. 2001

3. Pao H F Richard, “Fluid Mechanics”, John Wiley and Sons (1995).

4. J A Fay, “Introduction to Fluid Mechanics”, Prentice Hall of India Private Limited, New Delhi (1996)

5. Yunus Cengel& John Cimbala, “Fluid Mechanics: Fundamentals and Applications”, 2nd reprint 2007, Tata McGraw Hill, New Delhi

6. Som & Biswas, Fluid Mechanics, Tata-McGraw Hill, New York

BMA503: IC Engines

Credits : 4

LTP 310

Course Description: This course aims to improve understanding of the automobile engines and their operation and to use them to experience how materials on fluid mechanics, thermodynamics, and heat transfer studied in previous years integrates into a total engineering concept. The course also aims to advance student's problem solving skills such that the basics learned from the course can be used to deal with the real research and engineering challenges. On completion of this course, the students are expected to understand the fundamental principle, operation, performance of IC Engines, auxiliary systems, combustion of SI & CI engines, various fuels used and engine emissions.

Course Outcomes (CO):

At the end of the course the students should be able to:

1. Demonstrate knowledge of the different types of IC engines, their operations and operating cycles

2. Compute indicated/brake/friction power, sfc and efficiency and demonstrate an understanding of mixture preparation in SI & CI engines.

3. Demonstrate the ability to analyze the combustion process in SI and CI Engines.

4. Demonstrate an understanding of environment impacts of wide-spread use of internal combustion Engines, including social impacts of alternative fuels.

Unit I

Introduction to IC Engines: Heat Engine versus Internal combustion Engine, Historical development of IC Engines, Classification and Nomenclature, Applications of IC Engines. Brief review of Air standard cycles: Carnot, Otto, Diesel and Dual Cycle.

Working of IC Engines: Working of 4 stroke SI and CI Engines and their valve timing diagram, working of 2-stroke SI and CI engines and their valve timing diagrams, Comparison of two stroke and four stroke Engines.

Fuel Air Cycles and their analysis: Composition of cylinder gases, variable specific heats, Dissociation, Air standard versus fuel air cycles, Effect of operating variables like compression ratio, fuel air ratio. Actual engine cycles and losses: Comparison between Actual, Fuel- Air

cycle, Air standard cycles for S.I. and C.I engines.

Unit II

Measurement and Testing: Measurement of Friction Power, Brake Power, indicated Power, Measurement of Speed, Air consumption, fuel consumption, heat Balance Sheet for engine, governing of IC Engines. Performance Characteristics of IC Engines: Performance parameters, performance of SI engines, performance of C.I. engines, Engine performance maps.

Mixture Preparation Systems: Fuel supply system and fuel pumps, Simple carburetor and its working, Ideal requirements from an ideal carburetor, limitations of single jet carburetor, Different devices used to meet the requirements of an ideal carburetor, Petrol injection. Fuel Injection systems for CI Engines: Classification of Injection Systems, Injection Pump, Fuel Injector, Nozzle, and Injection in SI Engines.

Unit III

Combustion in SI Engine: Important qualities of SI engine fuels and their ratings. Stages of Combustion in S I Engine, flame front propagation, factors influencing the flame speed, ignition lag and factors affecting the ignition lag, Abnormal combustion and knocking, control and measurement of knock, Anti knock agents, combustion chambers of S I engines.

Combustion in CI Engines: Important qualities of CI engine fuels and their ratings. Stages of combustion, Delay period, factors affecting delay period; detonation and factors affecting detonation; comparison of abnormal combustion in SI &CI engine, rating of IC engine fuels, combustion chambers for IC engines.

Unit IV

Emission and Control: Emission of various pollutants from the engine, NO formation in S.I. engines, NO formation in C.I. engines, Emission of carbon monoxide, HC emission in S.I. engine and hydrocarbon emission in C.I engine, particulate emissions in S I engine, Soot formation fundamentals, Methods of controlling emissions; Catalytic convertors, Thermal reactors, Exhaust gas recirculation, EURO and BHARAT norms. Alternative fuels; Alcohol, Hydrogen, Natural gas and LPG, Biodiesel, biogas, Merits and demerits as fuels.

Text Books:

1. V Ganesan, “Internal Combustion Engine”, Tata McGraw Hill, New Delhi.
2. V. Domkundwar, “A Course In Internal Combustion Engines”, Dhanpat Rai Publishing

Suggested Readings:

1. J B Heywood, “Internal Combustion Engine Fundamentals”, McGraw Hill, Publication, New Delhi (1988).
2. C F Taylor, “The Internal Combustion in Theory and Practice”, Volume I and II, MIT Press, Cambridge, Mass (1968).
3. W WPulkrabek, “Engineering Fundamentals of Internal Combustion Engine”, Pearson Education, New Delhi (2003).
4. R Stone, “Introduction to Internal Combustion Engines”, 2nd Edition, Macmillan (1993).
5. B E Milton, “Thermodynamics, Combustion and Engines”, Champman and Hall (1995).

Web Links:

BMA509: CNC TECHNOLOGY

Credits : 2

LTP 200

Course Description: This course introduces the concepts and capabilities of computer numerical control machine tools. This course is to teach the students about the growing CNC technology in turning and milling operations. They will learn about the machine parts, their uses and the various controllers and codes.

Course Objectives: Upon completion of this subject, student will be able to:

CO1: Upon completion, student will be able to Classify and distinguish NC, CNC and DNC systems.

CO2: Develop manual and APT part programs for 2D complex profiles and test the programs through simulation.

CO3: CNC machine structures and system drives.

CO4: Develop interpolation algorithms for control loops.

Course Contents:

Unit I

Introduction to CNC machine tools

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection

Unit II

Tooling and Work Holding Devices

Cutting tool materials for CNC machine tools- hard metal insert tooling- inserts and tool holder classification – qualified – semi qualified and preset tooling – ATC – APC – tooling for machining and turning centre – silent tool – work holding devices for rotating and fixed work parts- use of probes in CNC machines – economics of CNC – maintenance of CNC machines.

Unit III

CNC Lathe: G & M codes in CNC turning, selection of feed speed and depth of cut, tool holder for lathe, process planning and part programming for CNC lathe, program verification, various program cycles in CNC lathe: linear interpolation, turning cycle, taper turning, taper facing, grooving/parting, circular interpolation/filleting, threading cycles, pattern repeating cycles, peck drilling cycle, boring, taper boring, internal grooving.

Unit IV

CNC Milling: G & M codes in CNC milling, selection of feed speed and depth of cut for milling, ATC, various program cycles in CNC milling: linear interpolation, circular interpolation, tool radius compensation, sub program call, mirroring, high speed peck drilling cycle, deep hole peck drilling cycle, tapping cycles, boring cycles, helical interpolation with varying radius and pitch.

Text Books:

1. Pabla B.S, CNC Machines, Adithan M. New Age International, New Delhi, 2014(reprint).

2. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill International, Singapore, 2006

Suggested Reading:

1. John Stenerson and Kelly Curran, Computer Numerical Control: Operation and Programming, PHI, New Delhi, 2009

2. TC Chang, RA Wysk and HP Wang, Computer Aided Manufacturing, PHI, New Delhi, 2009

3. Valention, J., and Goldenberg, J. Introduction to Computer Numerical Control (CNC). NY: Pearson, 2013.

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 Objectives: Upon completion of this subject, student will 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 cause for 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 on limits, fits and tolerances, design principles for limit gauges, Taylor's principles, types of limit gauges, tolerances on limit gauges, Design of limit gauges.

Geometrical Metrology and Surface Finish: Concepts of form errors; straightness, flatness, roundness errors and their measurements using computer aided measurement techniques, concept of micro and macro errors, measurement of surface roughness, stylus method using, mechanical, optical, electrical magnification methods.

Unit III

Screw Threads and Gear Metrology: Elements of screw threads metrology, measurement of major, minor and effective diameters of external and internal screw threads, measurement of pitch and screw thread 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. Displacement measurement, 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 Reading:

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

BMA507: INDUSTRIAL AUTOMATION

Credits : 4

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 (CO):

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 Content

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 and performance 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, Industrial 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/

BMA523: IC ENGINES LABORATORY

Credits : 1

LTP 002

Course Description: This course intends to familiarize the students with practical working of petrol and diesel Internal-combustion Engines and to estimate their performance as well as emission characteristics.

Course Outcomes (CO):

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

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

CO1: Calculate the performance characteristics such as Brake horse power (BHP), Mechanical efficiency and Specific fuel consumption (SFC) of a specific 2-stroke/4 stroke, petrol/diesel engine and make heat balance sheet for it.

CO2: Apply the concept of Morse test on SI engine (multi cylinder).

CO3: Draw BHP v/s fuel rate, air rate and A/F and (ii) BHP v/s Mech efficiency & SFC for single cylinder 4-stroke diesel engine.

CO4: Comprehend the effects of emission formation of IC engines.

List of experiments:

1. Dismantle a two stroke petrol and diesel engine. Note the function and material of each part, reassemble the engine.
2. Dismantle four stroke diesel engine. Note the function of each part, reassemble the engine.
3. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).
4. Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption. Draw/obtain power consumption curves.
5. To perform constant speed performance test on a single cylinder diesel engine & make the heat balance sheet for the same.
6. Performance testing of a 2-stroke petrol engine from no load to full load (at constant speed) for a single cylinder engine in terms of brake-power, indicated power, mechanical efficiency and specific fuel consumption. Draw/obtain power consumption curves.
7. To perform constant speed performance test on a single cylinder petrol engine & make the heat balance sheet for the same.
8. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.

Recommended Books / Suggested Readings

1. GNA University's Lab Manual on IC Engine.
2. Internal Combustion Engine Lab Manual by

BMA524: COMPUTER AIDED DESIGN – III LABORATORY

Credits : 2

LTP 004

List of Practicals:

Surface Modeling: Importance of surface modeling, various tools in surface modeling: rotational blend tool, fill tool, boundary blend, merge, trim, thicken, copy/publish geometry tool with its advantages, data migration concept with its advantages, merge/inheritance tool with its advantages.

Sheet Metal Modeling: Role and importance of Sheet Metal works Sheet Metal Modelling Fundamentals, Understanding Developed Length, Creating New Sheet Metal Model, Creating Planer Walls, Extruded and Revolved Wall Features, Understanding and Creating Secondary Flat Walls, Relief, Using Flange walls, Extruded Walls, Creating Bend, Unbend, Bend Back, Flat States Features, Creating Die Form Features, Punch Form Features, Rip Features.

List of Practical:

1. Drafting and detailing of Assembly 1 (gear profile).
2. Drafting and detailing of Assembly 2 (blower).
3. Drafting and detailing of Assembly 3 (grinder).
4. Drafting and detailing of pressure die casting component (choke cover).
5. Drafting and detailing of forging component (flange or rottle)
6. Drafting and detailing of blend surfaces.
7. Drafting and detailing of sheet frame.
8. Modeling of a tractor bonnet using sheet metal module.
9. Drafting and detailing of tractor bonnet.

BMA529: CNC TECHNOLOGY LABORATORY

Credits : 1

LTP 002

Course Description: This course is to teach the students about the growing CNC technology in turning and milling operations. They will learn about the machine parts, their uses and the various controllers and codes.

Course Objectives: Upon completion of this subject, student will be able to:

CO1: Develop manual and APT part programs for 2D complex profiles and test the programs through simulation.

CO2: CNC machine structures and system drives.

CO3: Develop interpolation algorithms for control loops

List of experiments:

1. Develop a part program for milling and simulate.
2 Develop a part program for taper turning and simulate
3. Develop a part program for circular interpolation and simulate
4 Develop a part program for multiple turning operation and simulate
5 Develop a part program for thread cutting, grooving and simulate
6 Develop a part program for internal drills, boring and simulate
7 Develop a part program for grooving and simulate on CNC Milling
8 Develop a part program for drilling (canned cycle) and simulate
9 Develop a part program for mirroring with subroutines and simulate
10 Develop a part program for rectangular and circular pocketing and simulate

Suggested Reading:

1. Pabla B.S, CNC Machines, Adithan M. New Age International, New Delhi, 2014(reprint).
2. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill International, Singapore, 2006

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 :

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.

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.

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):

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

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.

Course Content:

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

Medical 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.

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

BMA604: REFRIGERATION AND AIR CONDITIONING

Credits : 3

LTP 300

Course Description: This course aquiants the students to understand the application of thermodynamic principles within the air conditioning and refrigeration industry. Also it provides the knowledge through refrigeration practical training with hands-on experience incorporated in the course.

Course Outcomes (CO):

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

1. Understand the function of each of the major refrigeration system components: evaporator, compressor, condenser, and metering device
2. Describe the function of the refrigerant in a refrigeration system and trace its path
3. Understand how to use a gauge manifold for servicing
4. Understand how to evacuate a refrigeration system
5. Understand how to use at least three methods of leak detection
6. Understand the difference between refrigeration and air conditioning

Course Content:

Unit I

Basic Concept: Natural and Mechanical Refrigeration, Application of refrigeration, Units of refrigeration and Coefficient of performance, Refrigeration effect, cooling capacity and COP of a refrigerator, heating effect, heating capacity and COP as heat pump.

Bell Coleman Cycle and Aircraft Refrigeration: Bell Coleman Cycle and its analysis; optimum COP and pressure ratio, necessity of air craft refrigeration – air cycle refrigeration systems and their comparison. Vapor Compression Refrigeration system Introduction to refrigeration, applications of refrigeration, development of simple saturated Vapor compression refrigeration cycle, effect of change in evaporator and condenser pressure, effect of pressure drops, polytropic compression, methods of improvement in the performance of the cycle like sub cooling, superheating, use of heat exchanger, flash chamber and flash inter-cooler. Components of Vapor compression system Classification, construction and application of various components like compressors, condensers, evaporators, expansion devices, controls,

cooling towers etc.

Unit II

Refrigerant: types and classification, properties and nomenclature, azeotropes and environment friendly refrigerants. Other refrigeration systems Vapor absorption systems (NH3- H20, LiBr- H2O) steam jet refrigeration systems, thermoelectric refrigeration, vortex tube refrigeration.

Unit III

Fundamentals of Air conditioning: Introduction to air conditioning, psychometrics, important terms and definitions, enthalpy of air, adiabatic saturation temperature, measurement of properties, psychometric chart, its construction and use. Psychometric processes mixing, mixing with condensation, sensible heating and cooling, humidification and dehumidification, bypass factor and its role, evaporative cooling, drying process, working of air-washer. Air-conditioning systems Sensible heat factor, design of summer air conditioning system, calculation of dehumidified air quantity and apparatus dew point, ERSHF method, air-conditioning systems for monsoon and winter, air conditioning systems using all fresh air. Comfort and Cooling load Estimation Comfort and its requirements, mechanism of body heat loss, effect of heat on body and body defense mechanism, effective temperature, comfort chart and its use, factors affecting human comfort, Cooling load estimation, components of cooling load, sensible and latent loads, ASHRAE and CARRIER methods of load estimation.

Unit IV

Air Distribution and duct design: Components of air handling systems, principles of air distribution, types of supply and return air openings and related definitions, consideration s for selection and location of supply and return air openings. Duct design: General duct design, rules, principles of duct design, equivalent diameter of ducts ducting materials, friction chart and its use, methods of duct design.

Text Books:

1. "Refrigeration and Air Conditioning" Arora C P, 19th Edition, Tata McGraw Hill, Delhi (1985).
2. "Refrigeration and Air Conditioning", Pradad M2nd Edition, New Age International Private Limited, Delhi (2002).

Suggested Readings:

1. "Principles of Refrigeration", Dossat, R J, 4th Edition, Pearson Education (Singapore), India, (2002).
2. "Heating, Ventilating, and Air Conditioning", Mcquiston F G, Parker J D and Spilter J D, 5th Edition, John Wiley and Sons Inc, New York (2001).

Web Links:

1. http://nptel.ac.in/courses/112105128/
2.https://www.slideshare.net/ShubhamHadadare/refrigeration-and-air-conditioning-ppt-63954927
3.http://chettinadtech.ac.in/storage/12-02-08/12-02-08-12-01-04-1404-prakash_mech.pdf
4.http://www.engineeringbookspdf.com/textbook-refrigeration-air-conditioning-r-s-khurmi-j-k-gupta/

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):

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

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.

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 Practicals:

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-casting component (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)

BMA624: REFRIGERATION AND AIR CONDITIONING LABORATORY

Credits : 1

LTP 002

Course Description: This course aquiants the students to understand the application of thermodynamic principles within the air conditioning and refrigeration industry. Also it provides the knowledge through refrigeration practical training with hands-on experience incorporated in the course.

Course Outcomes (CO):

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

1. Understand the function of each of the major refrigeration system components: evaporator, compressor, condenser, and metering device
2. Describe the function of the refrigerant in a refrigeration system and trace its path
3. Understand how to use a gauge manifold for servicing
4. Understand how to evacuate a refrigeration system

List of Experiments:

1. Study of various elements of a vapor compression refrigeration system through cut section models / actual apparatus.
2. Study and testing the performance of domestic refrigerator.
3. Study the performance testing of Electrolux refrigerator.
4. Study and performance testing of an Ice plant.
5. Study and performance testing of window type room air conditioner.
6. Study and performance testing of water cooler.
7. Calculation/ Estimation of cooling load for a large building.
8. Visit to a central Air conditioning plant for study of processes for winter and summer air Conditioning.
9. Visit to a cold storage for study of its working.

BMA701: COMPUTER AIDED ENGINEERING

Credits : 4

LTP 310

Course Objectives:

1. To teach the students about the theory behind the Finite Element Modelling.
2. To learn and apply finite element method for various mechanical problems.
3. To Learn to model complex geometry problems and solution techniques.

Course Outcomes (CO):

Upon completion of this course student will be able to:

1. Understand the Concept of Finite element methods and its various methods
2. Derive an equivalent finite element model, including the appropriate boundary conditions.
3. Solve the engineering design problems using CAE techniques.
4. Generate the solution for complex problems using FEM concept.

Course Content:

Unit I

Historical Background: Introduction to CAE, Types, Application, Advantages, Disadvantages

Mathematical Modeling of field problems in Engineering: Governing Equations, Discrete and continuous models, Boundary value problems, Weighted Residual Methods, Minimum Potential Energy Method.

Unit II

Basic concepts of the Finite Element Method: Finite Element formulation, Discretization, Element types, Derivation of Shape functions and Stiffness matrices and force vectors, Assembly of Matrices.

1D-Problem Solving using FEM: Spring Element, Bar Element

Unit III

2D-Problem Solving using FEM: 2D-Bar element, Beam Element, Triangular elements, Shape functions and element matrices and vectors.

3D-Problem Solving using FEM: Truss Element, Tetrahedron Element

Unit IV

Application to Field Problems: Mesh Types, Selection of Appropriate mesh, Thermal problems, Torsion of Non circular shafts, Iso-parametric elements, Shape functions for iso-parametric elements.

Text Books:

1. An Introduction to Finite Element Methods 2nd Edition by J N Reddy.
2. Tirupathi R. Chandrupatla & Ashok D. Belugundu, Introduction to Finite Elements in Engineering, Prentice Hall.
3. Alavala, C. R. (2009). Finite element method: basic concepts and applications. New Delhi: PHI Learning.

Suggested Books:

1. David V Hutton, Fundamentals of Finite Element Analysis, Tata McGraw-Hill Education
2. Daryl L. Logan, A First Course in the Finite Element Method, Cengage Learning
3. S. S. Rao, (2011), The Finite Element Method in Engineering, Elsevier.

Weblinks:

1.http://nptel.ac.in/courses/112104116/

2.http://ceb.ac.in/knowledge-center/E-BOOKS/The%20Finite%20Element%20Method%20Vol1%20-%20The%20Basis%20-%20R.%20Taylor.pdf

3.https://www.engr.uvic.ca/~mech410/lectures/FEA_Theory.pdf

4.http://web.mit.edu/kjb/www/Books/FEP_2nd_Edition_4th_Printing.pdf

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

BMA721: COMPUTER AIDED ENGINEERING LABORATORY

Credits : 2

LTP 004

Course Outcome:

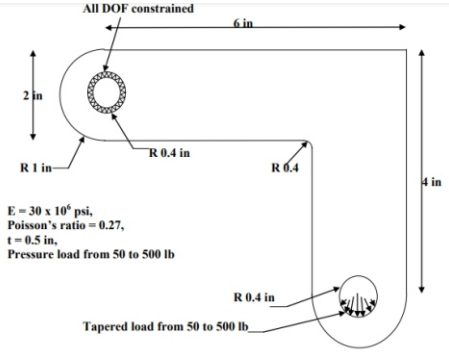
Upon Completion of the course student will be able to

1. Apply the computer-based techniques to solve structural problem
2. Apply the computer-based techniques to solve Thermal problem
3. Create and design Mechanical components using finite element methods, taking into account safe design limits.
4. Demonstrate the ability to use computer-based techniques for the analysis, of mechanical components

List of Practical:

1. Getting acquainted with the background and working environment of NX-Nastran software. (ii) Understanding and working with the basic graphics operations of the NX-Nastran environment.
2. Structural analysis on C-Section point load.
3. Structural analysis on I-Section uniformly distributed load.
4. Structural analysis on T-Section cantilever variably distributed load.
5. Torsional analysis of a rotating component.
6. Static analysis on forging component.
7. Stress analysis of a rectangular plate with a circular hole.
8. (i) For the variable cross-section bar fixed at one end and subjected to axially applied point loads, perform hand calculations to obtain the values of nodal displacements and elemental stresses. Divide the bar into three rectangular elements of different cross-sectional areas.
9. (ii) Model the problem in NX-Nastran and compare the results with those obtained through hand calculations.
10. (i) For the combined bending and torsion problem, use hand calculations to find the maximum values of bending stress and angle of twist. (ii) Model the same problem in NX-Nastran and compare the results with those obtained through hand calculations.
11. For the Axisymmetric problem, construct a model in Nastran and perform FEA

12. The corner angle bracket is shown below. The upper left hand pin-hole is constrained around its entire circumference and a tapered pressure load is applied to the bottom of lower right hand pin-hole. Compute Maximum displacement, Von-Mises stress.



13. In the Spanner under plane stress, find deformed shape and determine the maximum stress distribution. E = 2 x 105 N/mm2 , t = 3 mm, Poisson's ratio = 0.27, Analysis assumption – plane stress with thickness is used.
14. Thermal Analysis - 2D problem with conduction and convection boundary conditions (Minimum 2 exercises).

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.

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 (CO):

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.
   (iv) 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.

BMA800: 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 (CO):

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 (PEC)

BMA545: MECHATRONICS

Credits : 3

LTP 300

Course Description: The course aims to equip the students with the knowledge of modern electro-mechanical devices. The student is also imparted with the knowledge to control, measure and interpret various process with the help of mechatronics.

The course includes introduction to mechatronics, various sensors, transducers and actuators used for the control of various processes using mechatronics, mathematical modeling of physical process.

Course Outcomes (CO):

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

CO1: Integrate mechanical, electronics, computer science to develop a mechatronic system to control any physical process.

CO2: Convert any physical model to the mathematical model and write equation of motion for mechanical, electrical, pneumatic and hydraulic systems.

CO3: Interface the sensors and actuators of a mechatronic device to the computer/laptop.

CO4: Develop a suitable controller to obtain the desired performance from the system by recognizing the key features of different type of controllers.

Course Contents:

Unit I

Introduction Introduction to Mechatronics Systems - Integration of mechanical, electronics, control and computer science engineering, Elements of mechatronics system, Mechatronics in products - Measurement systems - control systems - traditional design and Mechatronics Design.

Unit II

Sensors, Transducers, Actuators Introduction - performance terminology - displacement position and proximity - velocity and motion - fluid pressure - temperature sensors - light sensors - selection of sensors - signal processing - servo systems. Actuators in Mechatronics System: Electric actuators, Stepper motors, DC motors, and AC motors.

Unit III

Mathematical Modeling of Dynamic Systems: Equations of motion of mechanical, electrical, pneumatic and hydraulic systems, Transforming physical model to mathematical model, Linearization, Frequency response, Modeling of different motors and generators, Laplace transformations, Sensitivity of the open-loop and closed-loop systems, Types of controller, Controller design using frequency domain and Laplace domain methods.

Unit IV

Microprocessors and Programmable Logic Controllers Introduction - Architecture - pin configuration - instruction set - programming of microprocessor using 8085 instructions - interfacing input and output devices - interfacing D/A converters and A/D converters - applications - temperature control - stepper motor control - traffic light controller. PLC- Mnemonics timers, internal relays and counters - data handling - analog input and output - selection of PLC

Recommended Books / Suggested Readings:

1. *Bolton, W., Mechatronics, Pearson Education Asia (2004).*

2. Lawrence J.Kamm, "Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics" , Prentice-Hall, 2000.

3. Nagrath, I. J. and Gopal, *M., Control System Engineering, New Age International (2008).*

BMA547: Composite Materials

Credits : 3

LTP 300

Course Description: This course aims to introduce to advanced composite materials and their applications. Develop fundamental relationships for predicting the mechanical and hygrothermal response of multi layered materials and structures. Develop micromechanical and macromechanical relationships for lamina and laminated materials with emphasis on continuous filament.

Course Outcomes (CO):

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

1) An ability to apply knowledge of mathematics, science and engineering;

2) An ability to design and conduct experiments, as well as to analyze and interpret data;

3) An ability to design a system, component or process to meet desired needs;

4) An ability to function on multi-disciplinary teams;

5) An ability to identify, formulate, and solve engineering problems;

6) An understanding of professional and ethical responsibility;

Course Content

Unit I

Introduction to Composite Materials: Define a composite, enumerate advantages and drawbacks of composites over monolithic materials, and discuss factors which influence mechanical properties of a composite Classify composites, introduce common types of fibers and matrices, and manufacturing, mechanical properties and applications of composites Recycling of composites Introduce terminology used for studying mechanics of composites

Unit II

Macromechanics of a Lamina: Review definitions of stress, strain, elastic moduli and strain energy Derive stress-strain relationships for different types of materials Derive stress-strain relationships for a unidirectional/bidirectional lamina Find the engineering constants of a unidirectional/bidirectional lamina in terms of the stiffness and compliance parameters of the lamina Derive stress-strain relationships, elastic moduli, strengths, thermal and moisture expansion coefficients of an angle ply based on those of a unidirectional/bidirectional lamina and the angle of the ply

Unit III

Micromechanical Analysis of a Lamina: Develop concepts of volume and weight fraction of fiber and matrix, density and void fraction in composites Find the nine mechanical and four hygrothermal constants: four elastic moduli, five strength parameters, two coefficients of thermal expansion and two coefficients of moisture expansion of a unidirectional lamina from the individual properties of the fiber and the matrix, fiber volume fraction, and fiber packing Discuss the experimental characterization of the above nine mechanical and four hygrothermal constants.

Unit IV

Failure, Analysis and Design of Laminates: Analyze the significance of stiffness, and hygrothermal and mechanical response of special cases of laminates Establish the failure criteria for laminates based on failure of individual lamina in a laminate Design laminated structures such as plates, drive shafts and thin pressure vessels subjected to in-plane and hygrothermal loads Introduce other mechanical design issues in laminated composites

Text Books:

1. P.K. Mallick, Fiber-Reinforced Composites, Materials, Manufacturing and Design - 2nd ed.

2. Composite Materials: Science and Engineering By Krishan K. Chawla, Springer.

3. B.D. Agarwal, L.J. Broutman, Analysis and Performance of Fiber Composites, 2nd ed., J. Wiley (1990)

Suggested Readings:

1. O.M. Daniel, O. Ishai, Engineering Mechanics of Composite Materials, Oxford Press, 1994.

2. Composite Materials – Fabrication by John Wanberg, Wolfgang Publications

Web Links:

1.http://nptel.ac.in/courses/112104168/

2.https://www.slideshare.net/JokiYagit/composite-materials-11728091

3. http://www.rsc.org/Education/Teachers/Resources/Inspirational/resources/4.3.1.pdf

BMA550: PROCESS PLANNING AND COST ESTIMATION

Credits : 3

LTP 300

Course Description: Both process planning and cost estimation are very important parts of any industry or business and go hand in hand for an operation to be executed successfully. A process is a set of activities that are carried out in a sequence to reach a goal or target to obtain the desired product. Cost estimation is the initial step in any business or making a budget and also to calculate the profit and loss.

The course includes methods of process planning and selection of jigs and fixtures, quality assurance methods, etc., methods of costing, types of estimates, and estimation of different types of jobs.

Course Outcomes (CO):

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

CO1: Understand steps involved in the selection of a process, production equipment and tooling.

CO2: Calculate various process parameters for various production processes.

CO3: Estimate various costs incurred - labor cost, material cost, over head charges, depreciation cost, etc.

CO4: Calculate machining time for different machining operations like operations on Lathe, drilling and Boring, milling, Shaping and Planning, grinding machines, etc.

Course Content:

Unit I

INTRODUCTION TO PROCESS PLANNING

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection.

Unit II

PROCESS PLANNING ACTIVITIES

Process parameters calculation for various production processes-Selection jigs and fixtures selection of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

Unit III

INTRODUCTION TO COST ESTIMATION

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost-allocation of over head charges- Calculation of depreciation cost

Unit IV

PRODUCTION COST ESTIMATION

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

MACHINING TIME CALCULATION

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

Text Books:

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.

Suggested Readings:

1. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley,1998.

2. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.

3. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.

Web Links:

1.http://nptel.ac.in/courses/105103023/35

2.http://library.bec.ac.in/kbc/NOTES%20BEC/MECH/7%20SEM/ME6005-Process%20Planning%20and%20Cost_2.pdf

BMA549: MAINTAINANCE ENGINEERING

Credits : 3

LTP 300

CPre-Requisites: N.A

Course Objectives:

1. To make the students understand the importance of Maintainance in the Industry.
2. To make the students learn the applicability of Type of Maintainance required.
3. To understand the concept of relaiablty and relate it to the maintainance.

Course Outcomes (CO):

After learning this course the students will be able to:

- Calculate the cost of maintainance for any industrial machinery
- Plan for the maintaince schedule of different machinery systems of the industry.
- To make the system more relaiable.

Unit I

INTRODUCTION

Objective and characteristics of maintenance function, Organization of the maintenance system, Operating practices in maintenance, Maintenance record keeping.

COST ASPECT OF MAINTENANCE

Costs of machine breakdown, estimation of life cycle costs, Application of work measurement in maintenance, Manpower planning and training, Incentive payments for maintenance.

Unit II

PLANNING OF MAINTENANCE ACTIVITIES

Evaluation of alternative maintenance policies breakdown, preventive and predictive maintenance, fault diagnosis and condition monitoring techniques, simulation of alternative practices, Development of preventive maintenance schedule, House keeping practices, total productive maintenance.

Unit III

MAINTENANCE ENGINEERING

Maintenance requirements of mechanical, electrical, process and service equipment, Safety aspect in maintenance, Aspect of lubrication; chemical control of corrosion, Computerized maintenance information systems

Unit IV

RELIABILITY

Concept and definition, configuration of failure data, various terms used in failure data analysis in mathematical forms, component and system failures, uses of reliability concepts in design and maintenance of different system.

Text Books:

1. Lindley R. Higgins, Maintenance Engineering Handbook, McGraw Hill.
2. R.H. Clifton, Principles of Planned Maintenance, Edward Arnold.
3. A Kelly, Maintenance Planning control, McGraw Hill.
4. L.S Srinath, Reliability Engineering, East West Press.
5. S.K. Sinha, Reliability Engineering, John Wiley.

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_NanoPr es_2_What%20is%20nano.pptx

BMA646: OPERATION RESEARCH

Credits : 3

LTP 300

Course Description: This course aims 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: The course aims to equip the students to familiarize with the Linux environment. The course includes fundamentals of shell scripting/programming.

Course Outcomes (CO):

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

CO1: Discuss the Installation and configuration process of Linux OS.

CO2: Determine Unix/Linux environment.

CO3: Write shell scripts to automate various tasks.

CO4: Describe the basics of Linux administration.

Course Outcomes:.

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

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BMA648: Product Life Cycle Management

Credits : 3

LTP 300

Pre-Requisites: ENGG 102, ROAU 207

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 PLM computer 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, Board room drivers - 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 for Product 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

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

BMA741: NON–TRADITIONAL MACHINING

Credits : 3

LTP 300

Course Description: Non-traditional machining processes is a group of processes that remove excess material by various techniques involving mechanical, thermal, electrical or chemical energy or combinations of these energies but do not use a sharp cutting tools as it needs to be used for traditional manufacturing processes. Traditional machining methods are often ineffective in machining hard materials like ceramics and composites or machining micro machined components under very tight tolerances such as in aerospace and electronics industries.

The course includes modern mechanical machining processes (USM, WJM, AJM, etc.), Electrochemical & Chemical machining processes, and Thermal Energy methods (EDM, PAM, LBM, EBM, etc.).

Course Outcomes (CO):

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

CO1: Understand the need of non-traditional machining processes and differentiate between traditional and non-traditional machining processes.

CO2: Explain the principle of working, advantages, limitations, and applications of various advanced mechanical processes - Ultrasonic machining, Water Jet Machining, Abrasive Flow Machining, etc.

CO3: Describe the principle of operation, advantages, limitations, and applications of Electrochemical & Chemical Removal Processes.

CO4: Understand the constructional feature of the equipment, process parameters, applications, advantages and limitations of Thermal Energy Methods – EDM, EBM, etc.

Course Content

Unit I

Introduction: Latest trends in Manufacturing, Introduction to Flexible manufacturing system, Introduction to computer integrated manufacturing, Limitations of conventional machining processes, Development of Non-conventional machining processes, their classification,

advantages and major applications

Unit II

Advanced Mechanical Processes: Ultrasonic machining, Water Jet Machining and Abrasive Flow Machining-elements of process, Applications and limitations.

Unit III

Electrochemical & Chemical Removal Processes: Principle of operation, elements and applications of Electrochemical Machining, Electrochemical grinding, electrochemical deburring, electrochemical honing, Chemical Machining, and Photochemical machining.

Unit IV

Thermal Energy Methods: DC Motor control, POTS and Analog Control, Stepper Motor Control-Electric Discharge Machining- Mechanism of metal removal, electrode feed control, die electric fluids flushing, selection of electrode material, applications. Plasma Arc Machining (PAM)- Mechanism of metal removal, PAM parameters, Equipment's for unit, safety precautions and applications. Laser Beam machining (LBM) - Material removal, limitations and advantages. Hot machining- method of heat, Applications and limitations. Electon-Beam Machining-, Generation and control of electron beam, process capabilities and limitations.

Text Books:

1. P.C. Panday and H.S. Shan, Modern Machining Processes, Tata Mc Graw Hill
2. G. Boothroyd and W.A. Knight, Fundamentals of Machining and Machine Tools, Marcel Dekker Inc.

Suggested Readings:

1. G.F. Benedict, Non-traditional Manufacturing Processes, Marcel Dekker Inc.
2. V.K Jain, Advanced Machining Processes, Allied Publishers
3. Hassan Abdel, Gawad El-hofy Fundamentals of Machining Processes: Conventional and Nonconventional Processes, Taylor & Francis

Web Links:

1.http://nptel.ac.in/courses/112105126/36
2.http://www.iitg.ac.in/spal/ME412M_NTM.ppt
3.https://www.slideshare.net/manudixit204/non-conventional-machining-processes

BMA742: INDUSTRIAL SAFETY

Credits : 3

LTP 300

Course Description: The purpose of this course is to teach student the concept of Industrial Safety. It also provides useful practical knowledge for workplace safety which helps identification, evaluation, and control of all the hazards.

Course Outcomes (CO):

Students completing this course should be able to:

1. Identify hazard and potential hazard areas.
2. Develop safety programs to prevent or mitigate damage or losses.
3. Assess safety practices and programs.
4. Conduct safety audits.
5. Improve safety practices.
6. Learn about the safety standards.

Course Content

Unit I

Importance of Safety, health and environment. Health safety and environmental policy, fundamentals of safety, classification of accidents, Managements responsibility, objectives of safety management, National safety council, Employees state insurance act 1948, approaches to prevent accidents, principles of safety management, safety organization, safety auditing, maintenance of safety, measurements of safety performance, industrial noise and noise control, Industrial Psychology, Industrial accidents and prevention. Introduction to OSHAS 18001 AND OSHA.

Unit II

Process safety management (P.S.M) as per OSHA, legal aspects of safety, safety with respect to plant and machinery, the explosive act 1884, Petroleum act 1934, personal protective equipment, classification of hazards, protection of respiratory system, work permit system, hazards in refineries and process plants, safety in process plants, pollution in some typical process industry.

Unit III

Safe working practices, housekeeping, safe working environment, safety device and tools, precaution in use of ladders, safety instruction during crane operation, safety instruction for welding, burning and cutting and gas welding equipment, electrical safety, case studies, safety in use of electricity, electric shock phenomena, Occurrence of electric shock, medical analysis of electric shock and its effect, safety procedures in electric plants, installation of Earthing system

Unit IV

Safety in hazardous area, hazard in industrial zones, classification of industrial Enclosures for gases and vapors. Mechanical, Chemical, Environmental and Radiation hazards, Machine guards and safety devices, slings, load limits, lifting tackles and lifting equipment, hydrostatic test, Chemical hazards, industrial toxicology, toxic chemicals and its harmful effects on humans, factors influencing the effect of toxic materials, Units of concentration, control measure, environmental hazards, devices for measuring radiation, safety analysis and risk analysis, risk management, First aid, Safety measures to avoid occupational diseases.

Text Books:

1. Industrial safety health and environment Management system By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second
2. Industrial safety management By: L.M. Deshmukh Publishers: Tata Megraw Hill ,New Delhi

Suggested Readings:

1. C. Ray Asfahl, Industrial Safety & Health Management, Prentice Hall, 5th edition

Web Links:

1.https://onlinecourses.nptel.ac.in/noc18_mg42/preview
2.https://www.slideshare.net/AnitaSharma7/industrial-safety-15679444
3.https://www.osha.gov/dte/outreach/construction_generalindustry/Safety_and_Health_Programs_v-03-01-17.pptx
4.http://portal.unimap.edu.my/portal/page/portal30/Lecturer%20Notes/KEJURUTERAAN_KOMPUTER/Semester%201%20Sidang%20Akademik%2020142015/DPT333%20Industrial%20safety%20and%20health/Chapter%201%20-%20Introduction%20-Zaizu_0.pdf

BMA743: PLC PROGRAMMING

Credits : 3

LTP 300

Course Description: 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 (CO):

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.
6. To design and program a small, automated industrial production line.

Course Contents

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

BMA744: INDUSTRIAL ENGINEERING

Credits : 3

LTP 300

Course Description: This course introduces the concept, tools, and techniques of industrial engineering viz. concepts of line balancing, work measurement, and production management etc., to enable the students to develop knowledge and skills in using and integrating these tools.

Course Outcomes (CO):

Students completing this course should be able to:

1. Describe the concept of industrial engineering, value engineering productivity and able to Solve and analyze problems using different forecasting techniques.
2. Analyze the units for various quantities of items of work through application of work study procedures and evaluate the rates for various items of work.
3. Analyze lacunae in existing layout of a shop floor in manufacturing and service organizations and develop an improved plant layout.
4. Practice material planning in industry through modern materials management tools like ABC analysis, Kanban, JIT etc.

Course Contents

Unit I

Introduction to Industrial Engineering: Concepts, History & Development of Industrial engineering, Roles of Industrial Engineer, Applications, Productivity, Factors affecting productivity, Increasing productivity of resources, Kinds of productivity measures, Value engineering, Macro and micro economics, Demand and supply, Factors influencing demand, Elasticity of demand.

Demand forecasting: Time series, Exponential smoothing casual forecast, Delphi method, Correlation and Regression, Barometric method, Long run and Short run forecast

Unit II

Elements of cost: Determination of Material cost, Labour cost, Expenses, Types of cost, Cost of production, Overhead expenses, Problems

Work Study: Introduction to work study, Method study, Time study, stopwatch time study,

Method Time Measurement (M-T-M), Work sampling, Plant location, Factors

Unit III

Plant layout: Types, Layout design process, Computerized Layout Planning, Construction and Improvement algorithms, ALDEP, CORELAP and CRAFT, Group technology, Problem definition, Production flow analysis, Heuristic methods of grouping by machine matrices, Flexible Manufacturing System, FMS work stations, Material handling and Storage system, Cellular Manufacturing System, Types of productions, Production cycle-Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing, Simple problems.

Unit IV

Materials Planning: ABC analysis, Incoming materials control, Kanban system, Just in time, MRP systems, Master Production Schedule, Bill of Materials, MRP calculations

Text Books:

1. Industrial Engineering And Management by O. P. Khanna, Dhanpat Rai Publications.
2. Industrial Engineering and Production Management by Martand Telsang, S. Chand Publications.
3. R Panneerselvam. (2006), Production/Operations Management, Prentice Hall of India Pvt Ltd

Suggested Readings:

1. Nigel Slack, Stuart Chambers, Robert Johnston., (2010) Operation Management, Pearson Education
2. R. Danreid & Sanders, Operations Management, John Wiley & Sons
3. E.S. Buffa, Modern Production / Operational Management, John Wiley & Sons

Web Links:

1.http://nptel.ac.in/courses/112107143/
2.https://www.slideshare.net/IsilTabag/industrial-engineering-presentation
3.http://ssmengg.edu.in/weos/weos/upload/EStudyMaterial/Mechanical/6thSem/industrial%20engineering%20Unit1/INDUSTRIAL-ENGINEERING.pdf

Humanities & Social Sciences including Management Courses

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 decision making 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 Contents

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 organisational, communication and teamwork requirements for effective quality management
4. Critically analyse the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans

Course Content

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.s

Course Content

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.
4. To determine the optimum time standards using work study principles and human factors in engineering.

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).