ACADEMIC CURRICULUM

(REGULATIONS R22)

FOR

BACHELOR OF VOCATIONAL DEGREE

CHOICE BASED CREDIT SYSTEM

(Applicable to the students admitted from the Academic Year 2022-23 onwards)

B.Voc. – PRODUCTION TECHNOLOGY

AUROVILLE INSTITUTE OF APPLIED TECHNOLOGY

(A Unit of Auroville Foundation)

Irumbai Main Road, (Opp. TN-E.B.)

Irumbai and P.O. - 605111. Vanur T.K.

Villupuram District, Tamil Nadu (India)

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1. Introduction

About B.Voc

Realizing the importance and the necessity for developing skills among students, and creating work ready manpower on large scale especially to meet the demand-supply mismatch in the Indian Economy, the University Grants Commission (UGC), Ministry of HRD, Government of India had launched a scheme on 27 February, 2014 for skills development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.). In these courses, the institute will conduct general education content and sector-specific skills will be imparted by Skill Knowledge Providers/ Training Providers/ Industries.

Auroville B.Voc Program

We are not here to do (only a little better) what the others do.
We are here to do what others cannot do because they do not have the idea that it can be done.
We are here to open the way of the Future to children who belong to the Future.
Anything else is not worth the trouble and not worthy of Sri Aurobindo's help
– The Mother, 6 September 1961.

While looking at the incredible advancement of science, the world continues to face an enormous crisis, especially the rural-urban divide and the disconnection of technological progress with human needs. ***Auroville*** is the city of the future and we are here to open the way of the future for youth who belong to the future. Our program and curriculum based on integral education address not only the **skills** needed by the youth, but also the **competencies** to use these skills to create a life-enhancing culture and interrupt unhealthy social narratives (or ISMs such as casteism, sexism, consumerism, etc.) and **develop inner capacity** (responsibility, dignity, courage to create) already present in the youth. The B.Voc programs over the three years are targeted for these. The program has been developed by academia, recent neuroscience and leadership training, industry leaders through research and application and includes recent online learning platforms such as Coursera.

In doing so we develop the five minds of the future as described by Daniel Goleman. Unlike most programs that only focus on the disciplined mind (learning a specific discipline) through this program we aim to develop the synthesizing mind (ability to abstract, compare, summarize), the respectful mind (respect and dignity for all), the ethical mind (developing systems and culture with care for people and planet), and the creative mind (creativity that comes from care as distinguished from innovation which may be limited to something new).

The methodology of all the courses will be to connect learning with application to make abstract learning concrete. Further, most courses as far as possible will be based on constructivism and constructionism i.e. in mini-projects that make something tangible. Even courses that are generally considered theoretical like Mathematics will be tied into applying it through visualization or programming. In line with this approach, the assessments will be based on applying what the students

care about to create in the first year small projects and in the following years larger projects for humanity. To encourage entrepreneurship the youth will also be required to make it into a prototype and give a presentation about the idea and create a flyer/three-fold brochure about their product and a report indicating the technical learning, problems solved and costs of the prototype. Viva will also be conducted with these submissions to ensure that the students understand the concepts and have the confidence to present themselves.

2. Key Features:

Objectives

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate National Skills Qualifications Framework (NSQF) within the undergraduate level of higher education to enhance employability of the students and meet industry requirements. Such student apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- To provide vertical mobility to students admitted in such vocational courses.
- The certification levels will lead to Diploma/Advanced Diploma/B. Voc. Degree in Production Technology and will be offered by Pondicherry University.
- Students may be awarded Level Certificate/Diploma/Advance Diploma /Degree as out-lined in the Table:

Award	Course	Duration after class XII	Corresponding NSQF level
Level 4 Certificate	Certificate	06 Months (30 Credits)	**4**
Level 5 Certificate	Diploma	1 Year (60 Credits)	**5**
Level 6 Certificate	Advance Diploma	2 Year (120 Credits)	**6**
Level 7 Certificate	**B.Voc. Degree**	**3 Year (180 Credits)**	**7**

3. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Production Technology so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired:

A. Understanding of

(a) The relevant basic concepts and principles in basic science subjects (Physics and Mathematics) so that he/she is able to understand the different vocational subjects.

(b) The basic concepts in engineering drawing using AUTOCAD.

(c) Different manufacturing processes.

(d) The concepts, principles of working different Machine tools.

(e) Importance of Production Technology.

(f) The knowledge of Production Processes.

(g) The production environment in the industry

(h) The concepts and principles used in Mass Production.

B. Adequate Professional Skills and Competencies in

(a) Selecting the raw material for the required Production according to the end product.

(b) Developing the devices required for mass production.

(c) Preparing the production layout according to the procedures involved in manufacturing

(d) Locating the fault at the production level due to improper process, scheduling etc. and its rectification.

C. A Healthy and Professional Attitude so that He/ She has

(a) An analytical approach while working on a job.

(b) An open mind while locating/rectifying faults.

(c) Respect for working with his/her own hands.

(d) Respect for honesty, punctuality and truthfulness.

D. NSQF compliant skills in Qualification developed by sector skill council in Capital Goods Sector.

4. Course Structure

The course will consist of a combination of practice, theory and hands on skills in the Capital Goods Sector. The curriculum in each of the years of the programme would be a suitable mix of general education and skill development components.

Skill Development Components:

- The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work ready. The skill development components will be relevant to the industry as per its requirements.
- The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.
- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.
- The curriculum will focus on work-readiness skills in each of the year of training.
- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

General Education Component:

- The general education component adheres to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, it will not exceed 40% of the total curriculum.
- Adequate emphasis is given to language and communication skills.

The curriculum should be designed in a manner that at the end of year-1, year-2 and year-3, students are able to meet below mentioned level descriptors for level 5, 6 and 7 of NSQF, respectively which are as given below:

Level	Process required	Professional Knowledge	Professional skill	Core skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools materials and information	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and learning and some responsibility for other's works and learning
Level 6	Demands wide range of specialized technical skill, clarity of knowledge and practice in broad range of activity involving standard/ non-standard practices	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Reasonably good in mathematical calculation, understanding of social, political and reasonably good in data collecting organizing information, and logical communication	Responsibility for own work and learning and full responsibility for other's works and learning
Level 7	Requires a command of wide ranging specialized theoretical and practical skill, involving variable routine and non-routine context	Wide ranging, factual and theoretical knowledge in broad contexts within a field of work or study	Wide range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Good logical and mathematical skill understanding of social political and natural environment good in collecting and organizing information, communication and presentation skill	Full responsibility for output of group and development

ELIGIBILITY FOR ADMISSION

Candidates for admission to B.Voc (Production Technology) shall be required to have passed 10+2 or 10+ITI (2 years) or its equivalent from a recognized board of examination.

ASSESSMENT

THEORY COURSES

All theory courses shall be assessed as follows:

Assessment Method	Marks
Continuous Assessment (Internal)	40
Semester Examination (External)	60
Total	100

Continuous Assessment (Internal)

Continuous Assessment (Internal)	Marks
Attendance	05
Internal Assessment Test	25
Assignments	10
Total	40

Attendance carries 5 marks (5 marks for 100% to 95% attendance, 4 marks for 94% to 90% attendance, 3marks for 89% to 85% attendance, 2 marks for 84% to 80% attendance and 1 mark for 79% to 75% attendance), cycle test carries 25 marks. Performance in the best two of the three tests will be taken for assessment. Assignments carrying 10 marks, shall be in the form of problems, small projects, quizzes, design problems, etc., depending upon the subject content.

Semester Examination

The pattern of Semester Examination question papers for theory courses is as follows:

a) The duration of the examination shall be 3 hours with a maximum of 60 marks.

b) Section A contains 5 compulsory questions each carrying 2 marks. Only one question shall be selected from each unit. This section carries 10 marks in total.

c) Section B contains five questions, one question from each unit with *'either' 'or' choice.* Each question carries ten marks. Based on necessity, each question may contain sub-divisions. This section carries 50 marks in total.

PRACTICAL COURSES:

All practical courses shall be assessed as follows:

Assessment Method	Marks
Continuous Assessment	40
Semester Examination	60
Total	100

Continuous Assessment (Internal)

Continuous Assessment (Internal)	Marks
Attendance	05
Model examination	15
Regular Laboratory Work	20
Total	40

Attendance carries 5 marks (5 marks for 100% to 95% attendance, 4 marks for 94% to 90% attendance, 3 marks 89% to 85% attendance, 2 marks for 84% to 80% attendance and 1 mark for 79% to 75% attendance).The regular performance in the practical class (Observation and Record) will be evaluated for 20 marks. Performance in the Model examination conducted at the end of the semester will be evaluated for 15 marks. The pattern of the Model Examination will be similar to the Semester Examination.

Semester Examination

The Semester Examination of the practical courses will be evaluated for 60 marks by a panel of examiners comprising an internal examiner and an external examiner. The Break-up of marks is as follows:

Procedure : 10 marks
Practical work and calculations : 40 marks
Viva-Voce : 10 marks

PROJECT WORK

The Project work carried out in the seventh and eighth semesters- shall be assessed as follows:

Assessment Method	Marks
Continuous Assessment (Internal Evaluation)	60
Semester Examination (External Evaluation)	40
Total	100

ii) Marks allocated for *Continuous Assessment* are distributed as given in the following table.

Assessment Method	Marks
Guide	25
Project Evaluation Committee	35
Total	60

a) The guide shall evaluate the student for 25 marks based on the work carried out.

b) The Project Evaluation Committee comprising the Head of the Department and two other faculty members shall evaluate the project for 35 marks. The evaluation will be carried out through three reviews. The Project Evaluation Committee is constituted by the Head of the Department.

iii) The final *Semester Examination* of the Project Work will be conducted by a panel of examiners comprising an internal examiner and an external examiner. The Break-up of marks is as follows:

Project report : 15 marks
Presentation : 15 marks
Viva-Voce : 10 marks

THEORY cum PRACTICE COURSES

All theory cum practice courses shall be assessed as follows:

Assessment Method	Marks
Continuous Assessment (Internal)	40
Semester Examination (External)	60
Total	100

Continuous Assessment (Internal)

Continuous Assessment (Internal)	Marks
Attendance	05
Internal Assessment Test	15
Regular Laboratory work	15
Total	40

Attendance carries 5 marks (5 marks for 100% to 95% attendance, 4 marks for 94% to 90% attendance, 3marks for 89% to 85% attendance, 2 marks for 84% to 80% attendance, and 1 mark for 79% to 75% attendance), Internal Assessment test comprises of cycle test carries 15 marks (Performance in the best two of the three tests will be taken for assessment) and the model examination conducted at the end of the semester and regular performance in the practical class (Observation and Record) will be evaluated 15 marks.

Semester Examination

The *Semester Examination* will be conducted as Semester Examination theory and semester Examination Practical each carries 30 Marks.

The pattern of Semester Examination question papers for theory courses is as follows:

a) The duration of the examination shall be 2 hours with a maximum of 30 marks.
b) Section A contains five questions, one question from each unit with *'either' 'or' choice.* Each question carries six marks. Based on necessity, each question may contain sub-divisions.

The Semester Examination of the practical courses will be evaluated for 30 marks by a panel of examiners comprising an internal examiner and an external examiner. The Break-up of marks is as follows:

Procedure : 10 marks
Practical work and calculations : 15 marks
Viva-Voce :05 marks

ON JOB TRAINING

Depending on the job role (Qualification Packs) that the students have chosen in the industries, the assessment for on-the-job training will be carried out in accordance with the relevant Skill Sector Council.

DECLARATION OF RESULTS

Examination Passing Criteria:

i) A student is declared to have ***passed*** a course if he gets 40% marks and above in the Semester Examination and 50% marks and above overall (Semester Exam marks and Continuous Assessment marks put together).

ii) If a student fails to clear the semester examination of a theory course after three consecutive attempts, the passing criteria from the fourth attempt onwards will be based on the marks earned by the student in the end-semester examination only. The student is deemed to have passed the course if the mark scored in the end semester examination is 50% and above and he will be awarded only an **C grade** irrespective of the mark scored.

AWARD OF GRADES

The performance of students in a course is expressed in terms of Letter Grades, each carrying certain Grade Points. A total of Six passing Grades namely O, A+, A, B+, B, and C is awarded. Total marks (s*um of Continuous Assessment and Semester Examination marks*) secured by a student in a course are used for computing his Grade by fitting the mark into the Range of Marks assigned for each Grade shown in the table below.

Range of Marks	**Letter Grade**	**Grade Points**
91 to 100	O	10
81 to 90	A+	9
71 to 80	A	8
61 to 70	B+	7
56 to 60	B	6
50 to 55	C	5
0 to 49	F	0
Absent	FA	0

8.2 A student who has secured an 'F' and 'FA' grade shall reappear for the examination in the following semesters. A student who has scored a passing grade other than an "F" and "FA" cannot reappear for the examination.

8.3 A student securing 'F' grade in an elective course may reappear for the examination in the following semester or drop the elective course and subsequently register for another elective course in the following semester in place of the dropped elective course.

8.4 *Grade Point Average* (GPA) indicates the performance of a student in all the examinations appeared by him in a particular semester. GPA score will appear in all the Semester Examination Grade Cards. The *Grade Point Average* (GPA) for a particular semester is calculated as the ratio of the sum of the products of the number of Credits of a course (C_i) and the Grade Points scored in that course (GP_i), taken for all the courses, to the sum of the number of credits of all the courses (n) registered in that semester.

$$GPA = \frac{\sum_1^n C_i GP_i}{\sum_1^n C_i}$$

where, n is the number of courses registered in that semester. For a student who has partially withdrawn from writing examinations of courses in a semester, n is counted as the total number of courses that appeared in that semester minus the number of courses partially withdrawn.

8.5 *Cumulative Grade Point Average* (CGPA) indicates the performance of a student in all the examinations appeared by him up to a particular semester. CGPA score will appear in all the Semester Examination Grade Cards starting from the first semester. The *Cumulative Grade Point Average* (CGPA) up to a particular semester is calculated as follows:

$$CGPA = \frac{\sum_1^n C_i GP_i}{\sum_1^n C_i}$$

where, C_i is the Credit of a course, GP_i is the Grade Point obtained by the student in that course and N is the total number of courses registered up to that semester starting from the first semester

CURRICULUM

Below Table shows for cumulative credits awarded to the learners in skill based vocational courses.

NSQF Level	Skill Component Credits	General Education Credits	Total Credits for Award	Normal Duration	Exit Points/ Awards
4	18	12	30	One Semester	Certificate
5	36	24	60	Two Semesters	Diploma
6	72	48	120	Four Semesters	Advanced Diploma
7	108	72	180	Six Semesters	B.Voc Degree

NSQF Level 4 SEMESTER - I							
Sl. No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
THEORY							
1	BVPTVC01	Basics of Manufacturing Process	VC	4	0	0	4
2	BVGPVG01	Basic Programming	VG	3	0	0	3
3	BVGPGSH01	English - I	GSH	2	1	0	3
4	BVGPGSH02	Applied Mathematics - I	GSH	3	0	0	3
LABORATORY							
5	BVGPVC02	Engineering Drawing using AUTOCAD (Theory cum Practice)	VC	2	0	4	4
6	BVPTVC03	Workshop Practice-I	VC	0	0	8	4
7	BVGPVG02	Programming Lab	VG	0	0	6	3
8	BVGPGSH03	Applied Physics - I (Theory cum Practice)	GSH	2	0	2	3
9	BVGPGSH04	Integral Yoga & Values-based Life and Leadership for Human Unity- I (Theory cum Practice)	GSH	1	0	4	3
			TOTAL CREDITS				**30**

NSQF Level 5 SEMESTER - II							
Sl. No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
THEORY							
1	BVPTVC04	Manufacturing Process - I	VC	4	0	0	4
2	BVGPGSH05	English - II	GSH	2	1	0	3
3	BVGPGSH06	Applied Mathematics - II	GSH	3	0	0	3
4	BVGPGSH07	Applied Physics - II	GSH	3	0	0	3
LABORATORY							
5	BVPTVC05	Workshop Practice - II	VC	0	0	8	4
6	BVGPGSH08	Integral Yoga & Values-based Life and Leadership for Human Unity- I Refresher and Application (Theory cum Practice)	GSH	1	0	4	3
ON-JOB-TRAINING (OJT)							
7	BVPTOJT01		OJT	8 weeks of Training			10
						TOTAL CREDITS	**30**

Students need to go On-Job-Training on any of the course in the qualification packs to get 10 credits

NSQF Level 6 SEMESTER - III							
Sl. No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
THEORY							
1	BVPTVC06	Manufacturing Process - II	VC	4	0	0	4
2	BVPTVC07	Production Technology	VC	4	0	0	4
3	BVPTVG03	Basic Electrical and Electronics	VG	3	0	0	3
4	BVGPGSH09	Basic 3rd Language (Hindi/German)	GSH	3	0	0	3
LABORATORY							
5	BVPTVC08	Production Technology Laboratory- I	VC	0	0	8	4
6	BVPTVG04	Basic Electrical and Electronics Laboratory	VG	0	0	6	3
7	BVGPGSH10	Applied Chemistry (Theory cum Practice)	GSH	2	0	2	3
8	BVGPGSH11	Indian culture and universal values	GSH	1	0	4	3
9	BVGPGSH12	Integral Yoga & Values-based Life and Leadership for Human Unity- II (Theory cum Practice)	GSH	1	0	4	3
			TOTAL CREDITS				**30**

NSQF Level 6 SEMESTER - IV							
Sl. No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
THEORY							
1	BVPTVC09	Mechanical Measurements and Metrology	VC	4	0	0	4
2	BVGPGSH13	Industrial Management and Professional Ethics	GSH	3	0	0	3
3	BVGPGSH14	Advanced 3rd Language (Hindi/German)	GSH	3	0	0	3
4	BVGPGSH15	Online course*	GSH	3	0	0	3
LABORATORY							
5	BVPTVC10	Production Technology Laboratory- II	VC	0	0	8	4
6	BVGPGSH16	Integral Yoga & Values-based Life and Leadership for Human Unity- II Refresher and Application (Theory cum Practice)	GSH	1	0	4	3
ON-JOB-TRAINING							
7	BVPTOJT02		OJT	8 weeks of training			10
						TOTAL CREDITS	**30**

*List of the course and offering organization will be provided by the department.

NSQF Level 7 SEMESTER - V							
Sl. No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
THEORY							
1	BVPTVC11	Production Automation & CIM	VC	4	0	0	4
2	BVPTVC12	CAD & CAM	VC	4	0	0	4
3	BVPTVEXX	Vocational Elective-I	VE	3	0	0	3
4	BVPTVG05	Basic of Mechanics	VG	3	0	0	3
5	BVGPGSH17	Placement Training & Skill Development Program - I	GSH	1	2	0	3
LABORATORY							
6	BVPTVC13	Production Technology Laboratory- III	VC	0	0	8	4
7	BVGPGSH18	Innovative and Design Thinking (Theory cum Practice)	GSH	1	0	4	3
EMPLOYABILITY/ ENTREPRENEURSHIP ENHANCEMENT COURSE							
8	BVPTEEC01	Project Phase- I	EEC	0	0	12	6
			TOTAL CREDITS				**30**

NSQF Level 7 SEMESTER - VI							
Sl. No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
THEORY							
1	BVPTVC14	Plant Layout and Product Handling	VC	4	0	0	4
2	BVPTVC15	Rapid Prototyping	VC	4	0	0	4
3	BVPTVEXX	Vocational Elective-II	VE	3	0	0	3
4	BVGPVG06	Maintenance and Safety in industry	VG	3	0	0	3
5	BVGPGSH19	Placement Training & Skill Development Program -II	GSH	1	2	0	3
LABORATORY							
6	BVPTVC16	Production Technology Laboratory- IV	VC	0	0	8	4
7	BVGPGSH20	Integral Yoga & Values-based Life and Leadership for Human Unity- III (Theory cum Practice)	GSH	1	0	4	3
EMPLOYABILITY/ ENTREPRENEURSHIP ENHANCEMENT COURSE							
8	BVPTEEC02	Project Phase- II	EEC	0	0	12	6
			TOTAL CREDITS				**30**

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PROGRAMME TOTAL CREDITS=180

GENERAL SCIENCE AND HUMANITIES (GSH)

Sl. No	Course Code	Subject	Semester	Credits
1	BVGPGSH01	English - I	I	3
2	BVGPGSH02	Applied Mathematics - I	I	3
3	BVGPGSH03	Applied Physics - I (Theory cum Practice)	I	3
4	BVGPGSH04	Integral Yoga & Values-based Life and Leadership for Human Unity- I (Theory cum Practice)	I	3
5	BVGPGSH05	English - II	II	3
6	BVGPGSH06	Applied Mathematics - II	II	3
7	BVGPGSH07	Applied Physics - II	II	3
8	BVGPGSH08	Integral Yoga & Values-based Life and Leadership for Human Unity- I Refresher and Application (Theory cum Practice)	II	3
9	BVGPGSH09	Basic 3rd Language (Hindi/German)	III	3
10	BVGPGSH10	Applied Chemistry (Theory cum Practice)	III	3
11	BVGPGSH11	Indian culture and universal values	III	3
12	BVGPGSH12	Integral Yoga & Values-based Life and Leadership for Human Unity- II (Theory cum Practice)	III	3
13	BVGPGSH13	Industrial Management and Professional Ethics	IV	3
14	BVGPGSH14	Advanced 3rd Language (Hindi/German)	IV	3
15	BVGPGSH15	Online course	IV	3
16	BVGPGSH16	Integral Yoga & Values-based Life and Leadership for Human Unity- II Refresher and Application (Theory cum Practice)	IV	3
17	BVGPGSH17	Placement Training & Skill Development Program - I	V	3
18	BVGPGSH18	Integral Yoga & Values-based Life and Leadership for Human Unity- III (Theory cum Practice)	V	3
19	BVGPGSH19	Placement Training & Skill Development Program -II	VI	3
20	BVGPGSH20	Innovative and Design Thinking (Theory cum Practice)	VI	3
		TOTAL CREDITS		**60**

VOCATIONAL CORE COURSES (VC)

Category - Vocational Core (VC)				
Sl. No	**Course Code**	**Subject**	**Semester**	**Credits**
1	BVPTVC01	Basics of Manufacturing Process	1	4
2	BVGPVC02	Engineering Drawing using AUTOCAD (Theory cum Practice)	1	4
3	BVPTVC03	Workshop Practice-I	1	4
4	BVPTVC04	Manufacturing Process - I	2	4
5	BVPTVC05	Workshop Practice - II	2	4
6	BVPTVC06	Manufacturing Process - II	3	4
7	BVPTVC07	Production Technology	3	4
8	BVPTVC08	Production Technology Laboratory- I	3	4
9	BVPTVC09	Mechanical Measurements and Metrology	4	4
10	BVPTVC10	Production Technology Laboratory- II	4	4
11	BVPTVC11	Production Automation & CIM	5	4
12	BVPTVC12	CAD & CAM	5	4
13	BVPTVC13	Production Technology Laboratory- III	5	4
14	BVPTVC14	Plant Layout and Product Handling	6	4
15	BVPTVC15	Rapid Prototyping	6	4
16	BVPTVC16	Production Technology Laboratory- IV	6	4
		Total credits		**64**

VOCATIONAL GENERAL (VG)

Category - Vocational General (VG)				
Sl. No	**Course Code**	**Subject**	**Semester**	**Credits**
1	BVGPVG01	Basic Programming	1	3
2	BVGPVG02	Programming Lab	1	3
3	BVPTVG03	Basic Electrical and Electronics	3	3
4	BVPTVG04	Basic Electrical and Electronics Laboratory	3	3
5	BVPTVG05	Basic of Mechanics	5	3
6	BVGPVG06	Maintenance and Safety in industry	6	3
			Total credits	**18**

VOCATIONAL ELECTIVE COURSES (VE)

Sl. No	**Course Code**	**Subject**	**Semester**	**Credits**
1	BVPTVEXX	Vocational Elective-I	V	3
2	BVPTVEXX	Vocational Elective-II	VI	3
		TOTAL CREDITS		**6**

List Of Vocational Elective Subject		
Sl. No	**Course Code**	**Subject**
1	BVPTVE01	Lean and Agile Manufacturing
2	BVPTVE02	Additive Manufacturing Process
3	BVPTVE03	Non-Conventional Machining
3	BVPTVE04	Production Planning and Control
4	BVPTVE05	Product Design for Manufacturing

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No	**Course Code**	**Subject**	**Semester**	**Credits**
1	BVPTEEC01	Project Phase - I	V	6
2	BVPTEEC02	Project Phase - II	VI	6
		TOTAL CREDITS		**12**

ON JOB TRAINING COURSE (OJT)

Category - ON-JOB-TRAINING (OJT)				
Sl. No	**Course Code**	**Subject**	**Semester**	**Credits**
1	BVPTOJT01	ON-JOB-TRAINING (OJT)	2	10
2	BVPTOJT02	ON-JOB-TRAINING (OJT)	4	10
		Total Credits		**20**

CREDIT DISTRIBUTION

SEMESTER	I	II	III	IV	V	VI	CREDIT
General Science and Humanities (GHS)	12	12	12	12	6	6	60
Vocational General (VG)	6		6		3	3	18
Vocational Core (VC)	12	8	12	8	12	12	64
Vocational Elective (VE)					3	3	6
Employability Enhancement Courses (EEC)					6	6	12
On Job Training Course (OJT)		10		10			20
TOTAL CREDITS	**30**	**30**	**30**	**30**	**30**	**30**	180

NON CGPA COURSES DETAILS

	I	II	III	IV	V	VI	VII
Sports			√	√	√	√	√
Library	√	√	√	√	√	√	√
Counseling	√	√	√	√	√	√	√

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC01	**BASICS OF MANUFACTURING PROCESS**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To know the fundamental tools and joints used in carpentry.
2	To know the fundamental tools and operations involved in Sheet Metals
3	To know the fundamental tools and operations involved in smithy shop
4	To learn about the basics joining operations involved in manufacturing process
5	To know the Process involving in protection of fabricated surface

THEORY

UNIT	TITLE	PERIODS
1	**CARPENTRY**	**14**

Fundamental of wood working operations - Common Carpentry Tools and Equipment - Their classification, size, specification (name of the parts and use only)- Carpentry Machines Joining of Timber Components for Fabrications Works: Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet, Groove, Tongue, Dowel, operations in assembly-simple lap and butt, Mortise, Tenon, Dovetail, Miter & bridle joints. Metal Fabrication. Defects Occurring & its remedy

UNIT	TITLE	PERIODS
2	**FITTING AND SHEET METAL OPERATIONS**	**14**

FITTING- Tools used in fitting shop (Marking tools, Measuring devices, Measuring instruments, Supporting tools, Holding tools, Striking tools, Cutting tools, Tightening tools, and Miscellaneous tools)- Operations performed in fitting work. Sheet metal working-Tools and operation: Metals used in sheet metal work - Tools and equipment used (Name, size, specifications - Operations involved: Blanking, Punching, Piercing, Perforating, Slotting, Drawing, Spinning, Notching, and Bending. - Characteristics of metals important in sheet forming - Progressive and compound dies – Common Defects Occurring & its remedy in sheet metal operations.

UNIT	TITLE	PERIODS
3	**METAL SHAPING-SMITHY**	**14**

Operations involved - Tool and equipment used (Names, size, specification) – Fuels used in Furnaces - Heating and fuel handling equipment - Holding and supporting tools - Striking Tools - Cutting tools - Punching & Drifting Tools - Bending Tools and figures - Forming & Finishing Tools - Defects Occurring & its remedy

UNIT	TITLE	PERIODS
4	**METAL JONING DURING FABRICATION**	**15**

Permanent Joining: Welding methods - Electric welding - Soldering & Brazing: Its concept, comparison with welding as joining method and classification - Soldering operation - Materials Used - Defects Occurring & its remedy Riveting: Its comparison with welding as joining method - Rivets and Materials - Operation involved - Tools and equipment used (Names, Size, specification and uses) - working of pneumatic, hydraulic and electric riveter. Temporary Joining (Fasteners & their uses), General Idea about temporary fasteners & their uses.

UNIT	TITLE	PERIODS
5	**PROTECTION OF FABRICATED SURFACES**	**15**

Painting: Its need, Introduction to methods of painting (classification only) - operations involved description steps only, surface preparation materials, tools and equipment used (name, size specification for identification), Brushes-round and flat wire brush, scraper, trowel, spray gun, compressor, Defects likely to occur in painting and their remedies. Varnishing & Polishing: Its need, operation involved (description of steps only), surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and sprit polish, copal varnish	
TOTAL PERIODS:	**72**
COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Know the fundamental tools and joints used in carpentry.
CO2:	Know the fundamental tools and operations involved in Sheet Metals
CO3:	Know the fundamental tools and operations involved in smithy shop
CO4:	Learn about the basics joining operations involved in manufacturing process
CO5:	Know the Process involving in protection of fabricated surface
TEXT BOOKS:	
1	Hazra & Chaudhry. - Workshop Technology, Vol. I.
2	Raghuvanshi, B. S. - Workshop Technology–Vol 1, Dhanpat Rai & Sons, New Delhi.
REFERENCE BOOKS:	
1	Rajender Singh. - Introduction to Basic Manufacturing Processes and Workshop Technology New Age International (P) Limited, Publishers

Course Code	Course Title	Periods per week				Credits
		L	**T**	**P**	**R**	
BVGEVG01	**BASIC PROGRAMMING**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To understand programming principles through visual programming
2	To explore Why Python and getting started Using Python
3	To learn Variables, Data Types and Expressions
4	To learn Conditional Code, Functions
5	To know the programming skills

THEORY

UNIT	TITLE	PERIODS
1	**PROGRAMMING PRINCIPLES THROUGH VISUAL PROGRAMMING**	**10**

Using visual programming (Scratch3, MIT) to explore principles of programming, control structures (if/then/else,loops - repeat, wait until, for, repeat until, forever, cloning), events (responding to keyboard, broadcast), motion and movement, animation looks and sounds, interactive gaming and sensing (user input, responding to mouse, callbacks), operators and variables.

UNIT	TITLE	PERIODS
2	**Why Python and getting started Using Python**	**11**

Motivation of learning Python, organizations and kinds of python and installation, basic Python console, IDE (Integrated Development Environments), Spyder installation and use.

UNIT	TITLE	PERIODS
3	**Variables, Data Types and Expressions**	**11**

Variables, Data Types (strings, numbers, lists, tuples, dictionaries), expressions with each of them, basic functions for Strings (concatenation, reverse, etc), numbers and functions available for numbers.

UNIT	TITLE	PERIODS
4	**Conditional Code**	**11**

Control and conditional code in Python boolean variables, if/else, if/elif/else, loops, range function, list comprehension, and conditional list comprehension

UNIT	TITLE	PERIODS
5	**Functions**	**11**

Creating functions for modularity and code reusability, generalization with input parameters to allow for code to be used in different situations.

TOTAL PERIODS:	**54**

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1:	Programming principles through visual programming
CO2:	Why python and getting started using python
CO3:	Variables, data types and expressions
CO4:	Conditional code

CO5:	Functions
TEXT BOOKS:	
1	Python Crash Course: A Hands-On, Project-Based Introduction to Programming (2nd Edition) Author: Eric Matthes. .
2	Basic Python Programming for Beginners by Dr. Marlapalli Krishna & S. Jaya Prakash Dr. Marlapalli Krishna, K. Varada Rajkumar (Author)
REFERENCE BOOKS:	
1	Programming with scratch: https://www.coursera.org/learn/programming-with-scratch
2	Python for Everybody: https://www.coursera.org/specializations/python

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH01	**ENGLISH I**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To encourage the students to speak English
2	To enable students to use English in day-to-day communication
3	To build up their confidence in the usage of English
4	To expose them to light prose and poetry
5	To develop their written and communicative competence
6	To re-introduce them to the basics of grammar

THEORY

UNIT	TITLE	PERIODS
1	**Prose**	**11**

The Bet- Anton Chekhov - With The Photographer- Stephen Leacock The Portrait of a Lady- Khushwant Singh - On The Face of It- Susan Hill - The Proposal- Anton Chekhov (Play)

UNIT	TITLE	PERIODS
2	**Poetry**	**11**

Say Not The Struggle Naught Availeth-Arthur Hugh Clough - Abu Ben Adhem -James Leigh Hunt -Where the Mind is Without Fear- Rabindranath Tagore-Daffodils: William Wordsworth-Stopping By Woods On A Snowy Evening- Robert Frost

UNIT	TITLE	PERIODS
3	**Spoken Communication**	**11**

Meeting People,Exchanging Greetings,Taking leave-Introducing Yourself- Introducing People To Others-Answering The Phone And Asking For Others-Discussing Hobbies,Likes And Dislikes

UNIT	TITLE	PERIODS
4	**Grammar And Vocabulary**	**11**

Articles-Modal Auxiliaries-Prepositions

UNIT	TITLE	PERIODS
5	**Creating Compositions**	**10**

Report Writing-Summarizing

TOTAL PERIODS:	**54**

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1:	Read and appreciate poems on their own.
CO2:	Analyze poetic texts using appropriate terms such as diction,tone,imagery,figures of speech,etc.
CO3:	Interpret a poem based on contextual evidence.
CO4:	Analyze various types of novels and stories and pieces of prose with reference to thematics and other approaches.
CO5:	Read and comprehend better.
CO6:	Communicate in English orally and in writing.

CO7:	Refer to the dictionary for synonymous expressions and grammar.
CO8:	Enlarge the vocabulary and understand the structure of sentences and grasp the idea of the author.
CO9:	Understand the basics of English grammar.
TEXT & REFERENCE BOOKS:	
1	Hornby,A.S. Guide To Patterns And Usage In English(ELBS)
2	Corder,S.Pit An Intermediate English Practice Book(Orient Longman)
3	Vallins,G.D. Good English:How To Write It(ELBS)
4	Vallins,G.D Better English
5	Zandvoort A Handbook Of English Grammar(ELBS)
6	Wood,F.T. A Remedial English Grammar For Foreign Students
7	Dowling,Dave Oxford Guide To Effective Writing And Speaking

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH02	**APPLIED MATHEMATICS I**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To understands Matrix theory, To develop the use of matrix algebra techniques for practical applications.
2	To understand mathematical tools needed in evaluating multiple integrals and their usage.
3	To make the students knowledgeable on effective mathematical tools for the solutions of differential equations that model physical processes
4	To understand the Basic on Analytical solid Geometry about Directional ratios and straight line
5	To make the students knowledgeable in the areas of direct and inverse functions of trigonometry.

THEORY

UNIT	TITLE	PERIODS
1	**MATRICES ITS APPLICATIONS**	**11**

Inverse and rank of a matrix, System of linear equations, Symmetric, Skew Symmetric and Orthogonal matrices, Eigen values and Eigenvectors of a real matrix, Characteristic equation, Properties of Eigenvalues. Cayley-Hamilton Theorem (statement only), Diagonalization of matrices.

UNIT	TITLE	PERIODS
2	**INTEGRAL CALCULUS**	**11**

Multiple Integral and its applications - change of order of integration. Applications: Areas (double integration) and volumes by triple integration (Cartesian and polar) – mass and center of mass (constant and variable densities)

UNIT	TITLE	PERIODS
3	**DIFFERENTIAL EQUATIONS**	**11**

Exact equations, First order linear equations, Bernoulli's equation, orthogonal trajectories, growth and decay, geometrical applications and electric circuits.

UNIT	TITLE	PERIODS
4	**ANALYTICAL SOLID GEOMETRY**	**11**

Directional cosines and ratios – angle between two lines – the equation of plane – equations to a straight line and shortest distance between two skew lines.

UNIT	TITLE	PERIODS
5	**TRIGONOMETRY**	**10**

Direct and inverse circular hyperbolic functions -logarithmic functions of a complex variable – Expansion of a trigonometric functions

TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	The students will get knowledgeable on Matrix theory and develop the use of matrix algebra techniques for practical applications.
CO2:	Understanding mathematical tools needed in evaluating multiple integrals and their usage.
CO3:	The students grow their knowledgeable on effective mathematical tools for the solutions of differential equations that model physical processes
CO4:	Understanding the Basic on Analytical solid Geometry about Directional ratios and straight line
CO5:	Know about the areas of direct and inverse functions of trigonometry.
TEXT BOOKS:	
1	Dr.M.K. Venkataraman, Engineering Mathematics, Vol. (I,II), National Publishing Co., Madras,2009
2	S. Narayanan and T. K. Manicavachagom Pillay, Trigonometry, S. Viswanathan (Printers and Publishers) Pvt. Ltd., (1997)
REFERENCE BOOKS:	
1	N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, New Delhi , 2007.
2	Veerarajan T, Engineering Mathematics (I, II) , McGraw-Hill Education(India) Private Limited, 2015
3	Erwin Kreyszig, Advanced Engineering Mathematics (9 th Ed), John Wiley & Sons, New Delhi, 2011.
4	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, Eleventh Reprint, 2010.
5	Bali N. and Goyal M., Advanced Engineering Mathematics, Laxmi Publications Pvt. Ltd., New Delhi, 9thEdition, 2011.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPVC02	**ENGINEERING DRAWING USING AUTOCAD (THEORY CUM PRACTICE)**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To learn how to properly dimension and annotate engineering drawings as per standards of engineering drawing practice and Students learn the application of engineering graphics through computer-aided drafting.
2	To follow and understand the basics of engineering drawing with simple solids.
3	To properly apply and produce sectional views of some regular solids.
4	To properly create multi-view orthographic drawings from three dimensional diagrams.
5	To present a drawing in orthographic and isometric projections.

THEORY

UNIT	TITLE	PERIODS
1	**PROJECTION OF POINTS AND STRAIGHT LINES**	**25**

Reasons for implementing – CAD - Applications of CAD - Benefits/limitations of CAD - Hardware of CAD system, Types of CAD software. AutoCAD- Commands - Types of lines – Dimensioning - Theory of Projection – Elements of projection, planes of projection - methods of projection - Standards for Engineering Drawing practice.
Projection of points - projections of straight lines - various positions of straight lines with reference-to-reference planes, traces of lines.

UNIT	TITLE	PERIODS
2	**PROJECTION OF PLANES AND SOLIDS**	**25**

Projection of Planes – Types of planes - projection of planes - various positions of planes with reference- to reference planes (Use First angle method of projection).
Projection of Solids – Types of solids - projection of solids in simple position - projection of solids with axis inclined to one reference plane and parallel to other. (Use First angle method of projection).

UNIT	TITLE	PERIODS
3	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES**	**26**

Section of solids – Regular solids prisms, cylinders, pyramids, cones and their parts. (Use First angle method of projection).
Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

UNIT	TITLE	PERIODS
4	**ORTHOGRAPHIC PROJECTION**	**26**

Orthographic Projection –Introduction to Orthographic projections - types of surfaces, invisible lines - precedence of lines - steps to draw orthographic views - orthographic projection of different objects. (Use First angle method of projection)

UNIT	TITLE	PERIODS
5	**ISOMETRIC PROJECTION**	**26**

Isometric projection – Theory of isometric projection - isometric view - isometric views from orthographic views for simple objects. (Use First angle method of projection).

	TOTAL PERIODS:	**128**
COURSE OUTCOMES:		
Upon completion of this course, students will be able to:		
CO1:	Learn to properly dimension and annotate engineering drawings as per standards of engineering drawing practice and Students learn the application of engineering graphics through computer-aided drafting.	
CO2:	Follow and understand the basics of engineering drawing with simple solids.	
CO3:	Properly apply and produce sectional views	
CO4:	Properly create multi-view orthographic drawings from three dimensional diagrams.	
CO5:	Present a drawing in orthographic and isometric projections.	
TEXT BOOKS:		
1	N.D. Bhatt, Engineering Drawing, 49th edition, Charotar Publishing House, 2014.	
2	K.Venugopal, Engineering Drawing & Graphics + Auto CAD, 4th Edition New Age Publications, New Delhi.	
REFERENCE BOOKS:		
1	K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.	
2	Dhananjay A Jolhe,Tata , Engineering Drawing with an introduction to AutoCAD, McGraw-Hill Publishing company limited	
3	D. M. Kulkarni, A. P. Rastogi and A.K.Sarkar; Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.	

Course Code	Course Title	Periods per week				
		L	T	P	R	Credits
BVPTVC03	**WORKSHOP PRACTICE- I**	**0**	**0**	**6**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

Carpentry shop: Tools and Equipment, Making of Various Joints, Pattern Making.

Fitting Shop: Tools and Equipment, Practice in Chipping, Filing and Drilling, Making of V, Dovetail and Square Joints of M.S Flat.

Welding Shop: Introduction to Tools and Equipments, Making of Various Joints Using Arc Welding, Gas Welding, MIG Welding, TIG Welding, Bead Formation in Horizontal, Vertical and Overhead Positions

Sheet Metal Shop: Tools and Equipment, Making Tray, Dust Pan, Cone, etc. with GI Sheet Metal

Smithy Shop: Tools and equipments, Making of Simple Parts like Hooks, Bolts, etc.

Painting and Polishing:
(EX-1) To prepare a wooden surface for painting apply primer on one side and to paint the same side. (EX-2) To prepare metal surface for painting, apply primer and paint the same.
(EX-3) To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system**.**

TOTAL PERIODS:	**144**

REFERENCE BOOKS:

1	Hazra & Chaudhry. - Workshop Technology, Vol. I.

Course Code	Course Title	Periods per week				Credits
		L	**T**	**P**	**R**	
BVGEVG02	**PROGRAMMING LAB**	**0**	**0**	**6**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To learn principles of basic programming and interactive programming with a visual programming language like Scratch 3 (MIT).
2	To become comfortable doing small projects in scratch 3.
3	To learn key principles of interactive programming and creating games and problem solving tasks
4	To learn the various ways to run the program on Windows, and Linux. Suggested editors and integrated development environment
5	To learn to work with various data types including string, list, tuples, dictionaries, Boolean and more. How to use variables based on the requirement
6	To control way of flow your program, create a own modules and define and use functions
7	Important built-in Python functions that you'll use often.

THEORY

UNIT	TITLE	PERIODS
1	**Introduction to Scratch, Events, control, sensing**	**11**

Sprites, stage, blocks, saving and loading projects, using mouse. Sprite options - code, costume, sound, background options - code, backdrop, sounds. Basic events, control Challenge: Story book with backdrop change or magic show.
Advanced Events, control, sensing of different types, basic operators Challenge: Interactive Q & A game, Make a maze game

UNIT	TITLE	PERIODS
2	**Logo turtle, Blocks, variables, Lists and operators**	**11**

Drawing with the pen and making different kinds of shapes Challenge: Mandalas with scratch.
Blocks help avoid repeat code and take parameters, variables help generalize code and add memory functionality, use of random number generator Challenge: Add scores to earlier programs, reduce lines of code with blocks, generalize Q & A e.g. cube root of a number questions generated on their own.
Advanced operators and lists to remember sequence of data and its processing Challenge: Enter a list of names 10 names and the program tests you to tell them backwards. Given an angle program calculates the cosine of the angle in degrees/radians.

UNIT	TITLE	PERIODS
3	**Python Setup, String and Variable, Number and Math**	**11**

Setup environment path variable, Command prompt, indentation, help, Immutable object, and non-immutable object, String Concatenation, Format string, String Operation
Numbers, Numeric Operations, Numeric Functions, Mathematical functions

UNIT	TITLE	PERIODS
4	**Boolean and Conditionals, Function and Method, Error Handling**	**11**

Basic Function syntax, calling a function, built-in function, user defined function(UDF),Anonymous Function, Method, Try Catch

UNIT	TITLE	PERIODS
5	**List and Dictionaries, Tuples, Files**	**10**
Slices, Loops, Sorting and Range, Create a list of dictionaries, Access key, and pair values, Update key, Append a Dictionary		
	TOTAL PERIODS:	**54**
COURSE OUTCOMES:		
Upon completion of this course, students will be able to know:		
CO1:	Learn principles of basic programming and interactive programming with a visual programming language like Scratch 3 (MIT).	
CO2:	become comfortable doing small projects in scratch 3	
CO3:	learn key principles of interactive programming and creating games and problem solving tasks	
CO4:	understand Object-oriented programming skills in Python	
CO5:	Skill to develop application with real time application	
CO6:	Ability work in advance programming skills in python	
CO7:	The fundamentals of how to store, retrieve, and process data efficiently.	
TEXT BOOKS:		
1	Michael H Goldwasser, David Letscher, “Object Oriented Programming in Python”, Prentice Hall, 1st Edition, 2007.	
2	YashavantKanetkar, Aditya Kanetkar, “Let us Python”, BPB publication, 1st Edition, 2019	
REFERENCE BOOKS:		
1	Coursera: Programing with Scratch	
2	Challenges to learn scratch https://www.auraauro.com/learn/learn-scratch/	
3	Ashok Kamthane, Amit Kamthane, “Programming and Problem Solving with Python”, McGraw Hill Education (India) Private Limited, 2018.	

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH03	**APPLIED PHYSICS – I (THEORY CUM PRACTICE)**	**2**	**0**	**2**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1.	To explain the fundamentals of elastic properties of solids.
2.	To understand the motion of waves and application of acoustics
3.	To learn to interpret and model physical phenomena using calculus
4.	To provide comprehensive knowledge and understanding of electricity and its applications
5.	To learn atomic and molecular physics and explain the macro physical phenomenon with it
6.	To acquire knowledge on fundamentals of physics and its applications in production and energy technologies

THEORY

UNIT	TITLE	PERIODS
1	**PROPERTIES OF MATTER**	**7**

Elasticity –- Hooke's law – Elastic moduli – Poisson's ratio – Beams – bending of beams – Expression for bending moment – Theory of uniform and non – uniform bending - Young's modulus - Koenig's method – Bernoulli s Theorem – Applications Viscosity- Co-efficient of Viscosity-Poiseuille's formula for co efficient of viscosity of a liquid- Stokes law-determination of viscosity-surface tension-molecular interpretation-Drop weight method

UNIT	TITLE	PERIODS
2	**WAVES MOTION AND APPLIED ACOUSTICS**	**7**

Waves Motion- General Transverse waves on a string, Travelling and standing waves on a string. Normal Modes of a string- Group velocity. Phase Velocity, Plane waves, Spherical waves. Wave intensity, Applied Acoustics, Intensity and loudness of sound- Decibels -Intensity levels – musical notes – musical scale- Acoustics of buildings. Reverberation and time of reverberation- Absorption coefficient

UNIT	TITLE	PERIODS
3	**INTERPRET AND MODEL PHYSICAL PHENOMENON WITH CALCULUS**	**7**

Rates and derivatives, straight-line kinematics - relationship between distance, speed, and acceleration. Integration to work backwards from acceleration, speed and distance. Description of the distance covered of a falling object as a function of time. Being able to draw this visually. Potential

UNIT	TITLE	PERIODS
4	**ELECTRICITY AND ELECTROMAGNETISM**	**7**

Charges, laws of electrostatics - Coulomb's law, Gauss's law, the electric field/force of a point charge (positive and negative), integrating along an electric line of force to get voltage, line of charge, plate of charge, relating to energy stored in a charge of a capacitor. Deriving the same with Gauss law.

UNIT	TITLE	PERIODS
5	**ATOMIC AND MOLECULAR PHYSICS**	**8**

Atomic picture of matter, atoms as building blocks. Using atoms to understand - everyday phenomena- air pressure, dynamic equilibrium, states of matter, melting and boiling point, things expand on heating, evaporation, diffusion, sound.	
TOTAL PERIODS:	**36**
COURSE OUTCOMES:	
Upon completion of this course, students will be able to know:	
CO1:	The basics of Properties of matter
CO2:	The fundamentals of Waves motion and applied acoustics
CO3:	The Interpret and model physical phenomenon with calculus
CO4:	About Electricity and electromagnetism
CO5:	The basics of Atomic and molecular physics
TEXT BOOKS:	
1.	Narayan Rao, (1998), B V, First Year B. Sc. Physics, New Age International (P) Lt. Supplementary Readings: 1. Halliday, D, Resnick R and Walker J, (2011), Fundamentals of Physics, Wiley India, Pvt Ltd.
2.	Mathur, D S (2002), Mechanics, S. Chand & Co.,
REFERENCE BOOKS:	
1.	Mathur, D S (2002), Properties of matter, S. Chand & Co.,
2.	Brijlal and Subramanian, (2006), Properties of matter, S. Chand & Co.,
3.	Rai, G D, Solar energy utilization, Khanna Publishers.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH03	**Applied Physics - I Lab**	**0**	**0**	**2**	**0**	**1**

PREREQUISITES:
NIL / Course Code – Course Title / Topics

COURSE OBJECTIVES:	
1	To learn atomic and molecular physics and explain the macro physical phenomenon with it
2	To learn to interpret and model physical phenomena using calculus
3	To learn electrostatics

UNIT	TITLE	PERIODS
1	**Atomic and molecular physics**	**12**
Building lattice structure (tetrahedron) for Carbon, Silicon used in semiconductors - Air pressure experiments: with balloon, sheets of paper, etc. - states of matter experiment: heating experiment, evaporation and condensation - diffusion experiment: ink and water.		
UNIT	TITLE	PERIODS
2	**Interpret and model physical phenomenon with calculus**	**12**
Measuring constant speed and distance and checking repeatability (use Incline slope for different speeds) - Measuring speed of falling objects using video camera - Potential energy: changing mass, changing distance - Conservation of energy through conservation of momentum (football and tennisball) - Tracing the voltage of a capacitor with constant current (simulation or setup).		
UNIT	TITLE	PERIODS
3	**Electrostatics**	**12**
Experiments with electrostatistics, positive and negative static charge - experiments with energy stored in capacitors of different value charged to the same potential (impact on LEDs).		

TOTAL PERIODS:	**36**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	understand atomic and molecular physics and explain the macro physical phenomenon with it
CO2:	interpret and model physical phenomena using calculus

CO3:	understand electrostatics and what voltage is

REFERENCE COURSES:	
1	The Aha Guide to Atoms - Balaji Sampath
2	8.02 Electricity and Magnetism at MIT https://web.mit.edu/8.02t/www/802TEAL3D/visualizations/coursenotes/index.htm by Dr. Sen-ben Liao, Dr. Peter Dourmashkin, and Professor John W. Belcher
3	Physics 102 - Electric Charges and Fields https://www.coursera.org/learn/physics-102-electric-charges-fields/home/welcome

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH04	**Integral Yoga & Values-based Life and Leadership for Human Unity- I**	**1**	**0**	**4**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To understand and analyze the evolutionary steps of nature and man
2	To explore different systems of yoga and their significance and limitations and understand the synthesis in Integral Yoga in its essence
3	To learn Radical Transformational Leadership tools and distinctions and to apply what I stand for (care about) in my everyday practice.
4	To learn systems thinking and design projects for cultural and systemic shifts and technical solutions in alignment with universal values.

THEORY

UNIT	TITLE	PERIODS
1	**Introduction to Yoga**	**6**
Meaning & relevance of yoga in human life; Fundamentals of yoga		
UNIT	**TITLE**	**PERIODS**
2	**Evolution: Progressive self-manifestation of Nature in man**	**6**
Bodily life, mental life, beyond mental life: higher life; Planes of consciousness; Involution		
UNIT	**TITLE**	**PERIODS**
3	**Integral Yoga**	**6**
Introduction to parts of the being, Aim of Integral Yoga		
	TITLE	**PERIODS**
LABORATORY		**72**

(I) Sourcing inner capacities
(ii) My Four Profiles
(iii) Distinction: Courage and Bravery
(iv) Background Conversations & Listening
(v) Watch 12 Angry Men and listing leadership traits
(vi) "You are my Hero" Noticing & Transforming disempowering cultural norms. Read book; discuss in Pairs.
(vii) Systems principles-Film: Story of Stuff
(viii)Architecture for Equitable Change: Partial & Conscious-Full Spectrum Response Model
(ix) Designing my breakthrough Initiative using CFSR
(x) Designing my breakthrough Initiative---Beyond Problem-solving--Realise & respond
(xi) Background Conversations & Leadership
(xii) Speaking powerfully to inspiring others to commit to action— speaking about my BTI
(xiii) Giving feedback to foster growth
(xiv) Complaints as a commitment for action

TOTAL PERIODS:	**90**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Be able to explain the evolutionary steps of nature and man
CO2:	To know different systems of yoga and their significance and limitations and understand the synthesis in Integral Yoga in its essence
CO3:	To apply Radical Transformational Leadership tools and distinctions and to apply what I stand for (care about) in my everyday life.

CO4:	To use systems thinking and design projects for cultural and systemic shifts and technical solutions in alignment with universal values.
REFERENCE COURSES/BOOKS:	
1	Sri Aurobindo. Synthesis of Yoga.
2	Indian Psychology Institute. https://infinityinadrop.net/infinityfiles/0-4-3-evo-longterm.php
3	Indian Psychology Institute. https://infinityinadrop.net/infinityfiles/0-3-1d-cons-integral.php
4	Monica Sharma. (2017). Radical Transformational Leadership: Strategic Action for Change, North Atlantic Publishing, at Berkeley, California

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC04	**MANUFACTURING PROCESS - I**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To learn in detail about the Casting process and its operations.
2	To learn in detail about different types of welding process and its techniques.
3	To understand the importance of the metal forming processes
4	To learn the steps involved in powder metallurgy technique for preparation of products.
5	To learn the different types of polymers and their industrial applications.

THEORY

UNIT	TITLE	PERIODS
1	**CASTING**	**14**

Casting - The pattern materials used, Types of Patterns - Types of pattern allowances - Moulding and Pouring: Classification of moulding sand, properties of moulding sand – Tools and equipment - Types of sands and their importance test, parting powders and liquids, Sand mixing preparation.

Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces, their construction and operation, metals and alloys. Special casting processes - Shell mould casting, die casing, investment mould casting, centrifugal and continuous casting full mould casting. Casting defects and remedies.

UNIT	TITLE	PERIODS
2	**WELDING**	**14**

Welding Arcs: Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes. Introduction to various welding processes with procedure equipment and applications - Electric arc welding (SMAW, TIG, MIG, SAW, and PAW) - Gas welding (oxyacetylene welding) - Resistance welding.
(iii) Thermite welding (iv) Carbon arc gauging. Welding defects and remedies. Introduction to welding testing standards of dissimilar metals and non-metals.

UNIT	TITLE	PERIODS
3	**METAL FORMING PROCESSES**	**14**

Classification of metal forming processes Rolling, Forging, Extrusion, Drawing and other Sheet metal operations: terminology used, processes, machines and defects.

UNIT	TITLE	PERIODS
4	**POWDER METALLURGY**	**15**

POWDER METALLURGY: Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing, Self-lubricated bearings. Advantages of the process and its limitations (Elementary concept only).

UNIT	TITLE	PERIODS
5	**PLASTICS AND POLYMERS**	**15**

Plastics and polymers - structure of polymer - additives in plastics - thermoplastics and thermosetting plastics - manufacturing of plastic products - different moulding methods - forming or shaping methods, laminating methods, machining of plastics, joining of plastics, industrial applications of plastics.

TOTAL PERIODS:	**72**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Describe in detail about the Casting process and its operatios.
CO2:	Understand in detail about different types of welding process and its techniques.
CO3:	Understand the importance of the metal forming processes
CO4:	Understand the steps involved in powder metallurgy technique for preparation of products.
CO5:	Explain the different types of polymers and their industrial applications
TEXT BOOKS:	
1	J.P.Kaushish Manufacturing Processes,Prentice Hall India Pvt. Ltd.,2008.
2	Hajra Choudhry, S. K.- Elements of Workshop Technology, Vol I, Media Promoters & Publishers Pvt., Ltd.
REFERENCE BOOKS:	
1	Jain, R. K.-A Text Book of Production Technology, Khanna Publishers, New Delhi.
2	Rao, P.N.–Manufacturing Technology (Casting, Forming and Welding), Tata McGraw Hill, New Delhi.
3	De Garmo, E.P.- Materials and Processes in Manufacturing, Prentice Hall of India, New Delhi.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH05	**ENGLISH II**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:
NIL / Course Code – Course Title / Topics

Course Objective	
1	To encourage the students to speak English
2	To enable students to use English in day-to-day communication
3	To build up their confidence in the usage of English
4	To expose them to light prose and poetry
5	To develop their written and communicative competence
6	To re-introduce them to the basics of grammar

THEORY		
UNIT	**TITLE**	**PERIODS**
1	**Prose**	**11**
How much Land Does A Man Need: Leo Tolstoy-Penalty: Premchand -The Painter Of Signs: R K Narayan-Arms And The Man: George Bernard Shaw (Play)		
UNIT	**TITLE**	**PERIODS**
2	**Poetry**	**11**
Do Not Go Gentle Into That Good Night: Dylan Thomas-If : Rudyard Kipling-Ozymandias: Percy Bysshe Shelley-Ode To Autumn: John Keats-The Dungeon: Samuel Taylor Coleridge		
UNIT	**TITLE**	**PERIODS**
3	**Spoken Communication**	**11**
The Art Of Public Speaking-Ability To Explain A Topic To Your Peers-Ability To understand Native Speakers And Repeat Sentences		
UNIT	**TITLE**	**PERIODS**
4	**Grammar And Vocabulary**	**11**
Tenses-Punctuation-Voice		
UNIT	**TITLE**	**PERIODS**
5	**Creating Compositions**	**10**
Essay Writing-Formal Letter Writing		
	TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Read and appreciate poems on their own.
CO2:	Analyze poetic texts using appropriate terms such as dictation, tone, imagery, figures of speech, etc.,
CO3:	Interpret a poem based on contextual evidence.
CO4:	Analyze various types of novels and stories and pieces of prose with reference to thematic and other approaches.
CO5:	Read and comprehend better.
CO6:	Communicate in English orally and in writing.

CO7:	Refer to the dictionary for synonymous expressions and grammar.
CO8:	Enlarge the vocabulary and understand the structure of sentences and grasp the idea of the author.
CO9:	Understand the basics of English grammar.

TEXT & REFERENCE BOOKS:	
1	Hornby,A.S. Guide To Patterns And Usage In English(ELBS)
2	Corder,S.Pit An Intermediate English Practice Book(Orient Longman)
3	Vallins,G.D. Good English:How To Write It(ELBS)
4	Vallins,G.D Better English
5	Zandvoort A Handbook Of English Grammar(ELBS)
6	Wood,F.T. A Remedial English Grammar For Foreign Students
7	Dowling,Dave Oxford Guide To Effective Writing And Speaking

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH06	**APPLIED MATHEMATICS II**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:
NIL / Course Code – Course Title / Topics

Course Objective	
1	To introduce Laplace transform, useful technique for solving many application problems and also to solve differential and integral equations.
2	To introduce students to use numerical methods and techniques for solving the problems
3	To create awareness about optimization in utilization of resources and Optimization Problem and apply operations research techniques to industrial operation
4	To introduce students to use network analysis and techniques for effective
5	To understand basic statistics and distributions

THEORY

UNIT	TITLE	PERIODS
1	**LAPLACE TRANSFORM AND ITS APPLICATIONS**	**11**

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems. Methods for determining inverse Laplace transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integral by Laplace transforms.

UNIT	TITLE	PERIODS
2	**NUMERICAL METHODS**	**11**

Numerical solution of algebraic and transcendental equations – Bolzono's bisection method – Successive approximation method – Regula falsi method – Newton Raphson method – Numerical solution of simultaneous linear algebraic equations – Gauss elimination method – Gauss Jordan elimination method – Gauss seidel iteration method.

UNIT	TITLE	PERIODS
3	**OPERATIONS RESEARCH**	**11**

Transportation Problem - Assignment Problem – Travelling salesman problem. Replacement problem – Replacement of items that deteriorate with time – Replacement of items that fail completely.

UNIT	TITLE	PERIODS
4	**NETWORK ANALYSIS**	**11**

Introduction to Network –Basic concepts – Construction of network diagram. Project Management: Introduction – Critical path method – Critical path determination – Optimal scheduling by CPM – PERT.

UNIT	TITLE	PERIODS
5	**PROBABILITY AND STATISTICS**	**10**

Probability, Events, Sample space, Axioms of probability, Random variable (Discrete and Continuous), Expectation, Probability Distribution: Binomial, Poisson & Normal distribution and statistical parameters of these distributions, Correlation and Regression, Rank correlation.

TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Knowing about Laplace transform, useful technique for solving many application problems and also to solve differential and integral equations.
CO2:	Students will use numerical methods and techniques for solving the problems
CO3:	Studemts gets awareness about optimization in utilization of resources and Understanding Optimization Problem and apply operations research techniques to industrial operation
CO4:	Students will use network analysis and techniques for effective
CO5:	Understanding basic statistics and distributions

TEXT BOOKS:	
1	M.K. Venkataraman, Engineering Mathematics, Vol. II, National Publishing Co., Madras, 2009
2	Numerical methods in Science and Engineering, M.K.Venkataraman, National Publishing co, Chennai 2001.
3	Operations Research, Kanti Swarup, P.K.Gupta and Man Mohan, S.Chand Publishers 1991.
4	Introductory of operations research theory and applications by H. S. Kasana & Kumar, Springer 2007
5	S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 10th Edition, Sultan Chand &Sons, New Delhi, 2000.

REFERENCE BOOKS:	
1	Veerarajan T, Engineering Mathematics II, McGraw-Hill Education(India) Private Limited, 2014
2	S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice-Hall of India Private Ltd, New Delhi.3rd Edition, 2000
3	Resource Management Techniques(Operations Research) by V.Sundaresan, K. S. Ganapathy Subramanian, K. Ganesan – A. R.Publications
4	Erwin Kreyszig, Advanced Engineering Mathematics (9 th Ed), John Wiley & Sons, New Delhi, 2011.
5	B. S. Grewal, : Higher Engineering Mathematics, Khanna Publishers, New-Delhi, 2008.
6	N.P. Bali & Manish Goyal: A text book of Engineering Mathematics, Laxmi Publications, New Delhi, 2008.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH07	**APPLIED PHYSICS II**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To understand the basic crystal structures and diffraction types of bondings.
2	To learn the thermodynamic system and its laws.
3	To understand the fundamental principles of semiconductors
4	To study the basic principle of laser and its production for different types of application
5	Gives the Knowledge of Conventional and non-conventional energy sources

THEORY

UNIT	TITLE	PERIODS
1	**CRYSTALS STRUCTURE**	**11**

Crystal Structure, bonding and properties -Crystal Lattice - Primitive and unit cell - seven classes of crystal - Bravais Lattice - Miller Indices - Structure of crystals - Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure Types of bonds in crystals - Ionic, covalent, Metallic, Vander Waal's and Hydrogen Bonding

UNIT	TITLE	PERIODS
2	**THERMODYNAMICS**	**11**

Thermodynamic system - Zeroth law, First and Second law of thermodynamics – Isothermal and Adiabatic Process - Carnot engine- working and efficiency - Carnot's theorem - Thermodynamic scale of temperature – Clausius and Kelvin Statement - Third law of thermodynamics - Entropy - Change in entropy in a reversible/ irreversible process – Application of heat and Thermodynamics

UNIT	TITLE	PERIODS
3	**SEMICONDUCTOR PHYSICS**	**11**

Intrinsic semiconductors – p and n doping - Carrier concentration and dependence on temperature PN junction theory - V-I characteristics of a PN junction diode - Half wave rectifier - Full wave rectifier -Bridge rectifier - Efficiency - filters - capacitor filter- choke input filter- pi filter - Zener diode - equivalent circuit - voltage regulator - LED - V-I characteristics – advantages - applications - photo diode - characteristics - applications.

UNIT	TITLE	PERIODS
4	**LASER PHYSICS AND ITS APPLICATION**	**11**

Spontaneous emission – Stimulated absorption and emission – Meta stable state –Population inversion – Pumping – types of pumping- main parts of Laser-principle of Laser Production of LASER – Solid State Lasers – Ruby Lasers - Nd : YAG laser – Gas lasers – Helium – Neon laser – CO2 laser – Semiconductor lasers – Diode laser Applications of LASER in cutting – Welding – Drilling – Hologram –material processing, Medicine and Communication

UNIT	TITLE	PERIODS
5	**ENERGY SOURCES AND ITS APPLICATION**	**10**

Kinds of energy – Mechanical energy, Thermal energy, Electrical energy, atomic and nuclear energy, (Examples) – Conservation of energy – work energy theorem. World's reserve of Commercial energy sources and their availability - India's production and reserves - Conventional and non - conventional sources of energy, comparison – Coal - Oil and natural gas –applications - merits and demerits. Photovoltaic systems (PV)- principle and applications in Powered fan – powered area - lighting system

TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Crystal structures and diffraction types of bondings.
CO2:	Thermodynamic system and its laws.
CO3:	The fundamental principles of semiconductors
CO4:	Principle of laser and its production for different types of application
CO5:	Conventional and non-conventional energy sources
TEXT BOOKS & REFERENCE BOOKS:	
1	Elements of Properties of Matter. D. S. Mathur, (S. Chand &Co)
2	Vibrations and waves. I .G. Main, (Cambridge University press)
3	Electricity and Magnetism, BrijLal& Subramanyam M, (2005), Ratan Prakashan Mandir Publishers.
4	Murugeshan R. and KiruthigaSivaprasath (2016) Modern Physics, S. Chand & CO.Ltd, New Delhi,6.
5	Narayan Rao, (1998), B V, First Year B. Sc. Physics, New Age International (P) Lt. Supplementary Readings: 1. Halliday, D, Resnick R and Walker J, (2011), Fundamentals of Physics, Wiley India, Pvt Ltd.
6	Mathur, D S (2002), Mechanics, S. Chand & Co.,
7	Mathur, D S (2002), Properties of matter, S. Chand & Co.,
8	Brijlal and Subramanian, (2006), Properties of matter, S. Chand & Co.,
9	Rai, G D, Solar energy utilization, Khanna Publishers.
10	Subramanyam and Brijlal (2004), A textbook of Optics, S. Chand and co., 22nd Edition.
11	Murugeshan, R (2008), Optics and Spectroscopy, S. Chand and co., 6t

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC05	WORKSHOP PRACTICE -II	3	0	0	0	3

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

FOUNDRY:
1. Study of foundry tools and equipment.
2. To prepare a mould using a given solid wooden pattern.
3. To prepare a mould using a given split aluminium pattern.

TURNING, SHAPING and MILLING
1. Step turning
2. Taper turning
3. Grooving and chamfering,
4. V – Thread cutting
5. Shaping Rectangular block using shaping machine.
6. Milling Rectangular Block or Cube

BLACK SMITHY
1. Prepare S-bend & J-bend for given MS rod using open hearth furnace.
2. Prepare the Square rod from a given round rod, by following hand forging operation.

STUDY EXPERIMENT
1. To study about the working process of injection molding
2. To study about the working process of blow molding.

TOTAL PERIODS: 54

REFERENCE BOOKS:

1	Hazra & Chaudhry. - Workshop Technology, Vol. I.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH08	**Integral Yoga & Values-based Life and Leadership for Human Unity- I Refresher and Application**	**1**	**0**	**4**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
COURSE OBJECTIVES:	
1	To incorporate aspects of integral yoga into life with meditation and reflection
2	To incorporate aspects of integral yoga into life with suryanamaskar
3	To integrate Radical Transformational Leadership tools in everyday practice.
4	To design projects for system and cultural shift from universal values
5	To learn distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential

THEORY		
UNIT	**TITLE**	**PERIODS**
1	**Review of Integral Yoga Principles**	**9**
Review Integral Yoga - physical, mental, vital alignment with psychic		
UNIT	**TITLE**	**PERIODS**
2	**RTL (Radical Transformational Leadership) Book Reading**	**9**
Understanding the praxis around the world around RTL		
	TITLE	**PERIODS**
LABORATORY		**72**
To learn and incorporate daily meditation To learn and incorporate suryanamaskar To reflect weekly on the progress made physically and mentally Reflection on the tools applied in day to day life. Conversations for clarity and refreshers. Refresher on design templates and design and refining the breakthrough initiative at college.		
	TOTAL PERIODS	**90**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
1	Develop in meditation and reflection
2	Develop physically through suryanamaskar
3	Use Radical Transformational Leadership tools in everyday practice.
4	Design projects for system and cultural shift from universal values
5	Notice distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential

REFERENCE COURSES/BOOKS:	
1	Altered Traits: Science Reveals How Meditation Changes Your Mind, Brain, and Body- Daniel Goleman and Richard Davidson
2	Monica Sharma. (2017). Radical Transformational Leadership: Strategic Action for Change, North Atlantic Publishing, at Berkeley, California

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC06	MANUFACTURING PROCESS - II	4	0	0	0	4

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To learn the different types of lathe and its techniques involved in various operations
2	To learn about the Shaping, Planning, Slotting and drilling machines.
3	To learn about the principle of milling machine.
4	To learn about the different types of grinding machine and its operation technique.
5	To learn the jigs and fixtures used in manufacturing industry.

THEORY

UNIT	TITLE	PERIODS
1	**CENTRE LATHE**	14

Lathe – Types of Lathes, tools, Specification and Size - Work holding devices – Lathe operations. Feed mechanism and change -gears - Cutting Speed, Feed and Depth of Cut, Material Removal Rate - Operations, Machining Time. Brief description of semi-automatic lathes such as capstan and turret lathes, their advantages and disadvantages over centre lathe, types of job done on them. General and periodic maintenance of a centre lathe.

UNIT	TITLE	PERIODS
2	**SHAPING, PLANING, SLOTTING AND DRILLING MACHINES**	14

Shaper - Working principles of Shaper machine – Types of shaping operations. Planer - Working principles of Planner machine – Types of Planning operations. Slotting Machine and its operations. Differences and similarities among them – Mechanism of the machines. General and periodic maintenance of a shaper, Planner and slotting machine.

Drilling & boring machines: Types of operations in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance.

UNIT	TITLE	PERIODS
3	**MILLING MACHINE**	14

Milling Machine - Types of milling machines - constructional features of milling machine - types of milling cutters - Milling operations - Simple, compound and differential indexing - Machining Time, Material Removal Rate and Gear cutting

UNIT	TITLE	PERIODS
4	**GRINDING MACHINE**	15

Grinding Machine: Common abrasives - grinding wheel materials, Bonds, Grain and grit of abrasive, Grain structure and shapes of common wheels - various speeds and feeds - Use of coolants, Methods of grinding, Types of grinding machines and grinding operations, precision finishing operations – honing, Lapping, and Super finishing.

Broaching Machines: Types of work done on broaching machine. Simple types of broaches and their uses, Types of broaching machines.

UNIT	TITLE	PERIODS
5	**JIGS AND FIXTURES**	15

Object of Jigs and Fixture: Difference between jigs and fixtures - Principle of location - Principle of clamping - Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs-bushes (Fixed, Liner, Renewal, Slip). Template, Plate jigs. Channel jigs, Leaf jigs, Simple example of milling,

turning, grinding, horizontal boring fixtures and broaching fixtures. Welding fixture. Cutting fluids – Functions, characteristics and types, Selection of cutting fluids.	
TOTAL PERIODS:	**72**
COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Explain the different types of lathe and its techniques involved in various operations
CO2:	Know the principle involved in the Shaping, Planning, Slotting and drilling machines.
CO3:	Describe the principle of milling machine.
CO4:	Explain the different types of grinding machine and its operation technique.
CO5:	Describe the jigs and fixtures used in manufacturing industry.
TEXT BOOKS:	
1	P.N.Rao, “Manufacturing Technology- Metal Cutting and Machine Tools”, - Tata McGraw Hill Publishing Company Ltd, 3rd edition, New Delhi, 2013.
2	S.K.Hajra Choudry - Workshop Technology, Vol.-I,&II, Media Promoters and Publishers Pvt. Ltd.,1997.
REFERENCE BOOKS:	
1	Kalpakjian, S. - Manufacturing Engineering and Technology, Pearson Education, Singapore
2	Jain, R. K.-A Text Book of Production Technology, Khanna Publishers, New Delhi.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC07	PRODUCTION TECHNOLOGY	4	0	0	0	4

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To learn about the production machine tools and techniques involved in transfer machine
2	To learn about the generation of forms like gear shaping and hobbing.
3	To learn about different types of cutting tools and its materials used in machining.
4	To learn about the press tools, fits and tolerance.
5	To understand the concept of surface treatment and surface finishing.

THEORY

UNIT	TITLE	PERIODS
1	**PRODUCTION MACHINE TOOLS**	14

PRODUCTION MACHINE TOOLS: Machine tools used for quantity production - semi-automatic multi tools centre lathe. Auto-lathes - sliding head types - Single spindle automatics, multi-spindle automatics, and Mechanical copying systems - Hydraulic servo copying systems for lathe, Electric copying systems.
TRANSFER MACHINES: Types of productions - Types of layouts - Economic justification of transfer machines - Inline transfer - drum type transfer machines. Automatic loading & Transferring methods, Machining heads, Automatic inspections, Tool servicing, Transfer press linked lines.

UNIT	TITLE	PERIODS
2	**GENERATION OF FORMS**	14

GENERATION OF FORMS: Forming `V' generating - Thread chasing - Die heads - Thread rolling, Thread milling, and Thread grinding. - Gear planning, Gear shaping, Gear hobbing, Straight Bevel Gear Manufacture. Spiral bevel Gear Manufacture.

UNIT	TITLE	PERIODS
3	**CUTTING TOOLS FOR MACHINING**	14

CUTTING TOOLS FOR MACHINING: Elements of machining process, Single point tools -Basic angles - Chip formation - Effect of manipulating factors such as velocity, size of cut, effect of tool geometry, Tool material (Tool steels, High speed steel, Cast cobalt alloys. Carbides or sintered carbide, Ceramics, Carbide tools) - Cutting fluids and contamination in them, Work piece material, Tool life model, Machining economics, Specific power consumption. Basic principles of multipoint tools, Linear travel tools, Broaches, Gear shaper cutters, Axial feed rotary tools-Twist drill, Reamers, Core drills, Counter bores and counter sinks, Multiple diameter tools, Hobs.
Surface treatment of cutting tools- Its advantage, Tin coated high speed steel diamonds. Cubic boron nitrides, Specialised knowledge of steel cutting

UNIT	TITLE	PERIODS
4	**PRESS TOOLS**	15

PRESS TOOLS: Factors affecting press tool design, Shearing, Bending, Drawing, combination tools, Progression tools, Rubber die formatting, high energy forming, Explosive forming.
SPECIFICATION OF QUALITY & RELIABILITY: Quality, Specification Designing for production Standardisation, Preferred numbers, Limits and fits, Tolerance - Geometric tolerances. Limit gauging

UNIT	TITLE	PERIODS
5	**SURFACE TREATMENT & FINISHING**	15

SURFACE TREATMENT & FINISHING: Surface treatment and its purpose, Elements of surface treatment cleaning protecting, Colouring, Altering surface properties. Surface Treatment Processes- Wire brushing,

Belt sanding, Alkaline cleaning, Vapour degreasing, Pickling, Latest trends in Surface preparation, Ultrasonic cleaning, Solvent cleaning, Painting application by dipping, Hand spraying, Automatic spraying, Electrostatic spray finishing. Electrocoating - Hot dip coating, phosphate coating- Packerising and bonderasing, Buffing, Blackening, Anodising. Electro Nickle Plating, Nickle carbide plating, Sputtering, Automation in Painting.	
TOTAL PERIODS:	**72**
COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Understand about the production machine tools and techniques involved in transfer machine
CO2:	Describe about the generation of forms like gear shaping and hobbing.
CO3:	Understand the different types of cutting tools and its materials used in machining.
CO4:	Know about the press tools and understand the importance of fits and tolerance in manufacturing process.
CO5:	Understand the concept of surface treatment and surface finishing.
TEXT BOOKS:	
1	P C Sharma, Production Engineering, S Chand Publication
2	Donaldson, Tool Design, Tata McGrow Hill
REFERENCE BOOKS:	
1	Krar, Technology of Machine Tool, Tata McGrow Hill.
2	C K Singh, Production Technology, Standard Publishers Distributors

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVG03	**BASIC ELECTRICAL AND ELECTRONICS**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To understand how a potential difference (voltage) can cause an electric current flow through a conductor
2	To learn about alternating voltage and current.
3	To learn the working principle of Electrical Machines
4	To Learn the basics of semiconductor and diodes.
5	To understand the application and principle of Transistors and Amplifiers.

THEORY

UNIT	TITLE	PERIODS
1	**ELECTRICITY AND D.C CIRCUITS**	**11**

Definition of Resistance, Voltage, Current, Power, Energy and their units, Relation between electrical, mechanical and thermal units, Temperature variation of resistance, Difference between AC and DC voltage and current D.C. Circuits - Ohm's Law, Series – parallel resistance circuits, calculation of equivalent resistance, Kirchhoff's Laws and their applications.

UNIT	TITLE	PERIODS
2	**A.C CIRCUITS**	**11**

Generation of A.C. voltage, its generation and wave shape. Cycle, frequency - peak value - R.M.S. value, form factor, crest factor, Phase difference, power and power factor, A.C. Series Circuits with - resistance and inductance - resistance and capacitance and - resistance inductance and capacitance, Q factor of R.L.C. series circuits. Three-phase balanced circuits: voltage and current relations in star and delta connections – Power measurement by two Wattmeter method.

UNIT	TITLE	PERIODS
3	**ELECTRICAL MACHINES**	**11**

Elementary concept of rotating machines – Flemming's right hand and left-hand rule – DC Machines: Construction and working of DC Machines - Generator and Motors – Emf equation of DC generator and back emf of DC motor –characteristics - Types of DC Machines. AC Machines: Construction and working of Single phase & three phase induction motors and synchronous generator (qualitative approach only).

UNIT	TITLE	PERIODS
4	**SEMICONDUCTOR AND DIODES**	**11**

Semiconductor Classification - Semiconductor bonds - Energy band description - Semiconductor types - Hall effect. Diodes: - P-N junction - V-I Characteristic - diode equivalent circuits, semiconductor diodes, rectifiers - (efficiency, ripple factor), filters, clipers, clampers.

UNIT	TITLE	PERIODS
5	**TRANSISTORS AND AMPLIFIERS**	**10**

Transistors: - BJT construction, characteristics (CB, CE, CC), load line. BJT biasing. FET, JFET, MOSFET (Depletion and enhancement), FET biasing. Amplifiers: - Single stage amplifiers, voltage gain, effect of frequency on Gain, multistage amplifier. Other Semi-conductor devices - SCR, DIAC, LASCR, TRIAC, and other thyristors, basic theory of operation, characteristics, Theory and operation of UJT, Oscillators: - Feedback BH criteria, oscillator types, sinusoidal oscillator, Hartley oscillator, Collpitts Oscillator, Phase shift,Wein bridge oscillator, crystal oscillator.

TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	understand how a potential difference (voltage) can cause an electric current flow through a conductor
CO2:	Understand about alternating voltage and current.
CO3:	Know the working principle of Electrical Machines
CO4:	Understand the basics of semiconductor and diodes.
CO5:	Know the application and principle of Transistors and Amplifiers.
TEXT BOOKS & REFERENCE BOOKS:	
1	D. P. Kothari and L. J. Nagrath, “Basic Electrical Engineering”, 3rd Edition, Tata McGraw Hill, 2017.
2	D. C. Kulshreshtha, “Basic Electrical Engineering”, Tata McGraw Hill, 2011.
3	Ritu Sahdev, Basic Electrical Engineering, , Khanna Publishing House.
4	S. Biswas, Basic Electronics, Khanna Publishing House
5	A.K. Maini, All in One Electronics Simplifies, Khanna Publishing House

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH09*	**HINDI I**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To introduce the students to Hindi Alphabet and To encourage the students to speak Hindi
2	To enable students to use Hindi in day-to-day communication
3	To build up their confidence in the usage of Hindi
4	To expose them to light poetry
5	To introduce them to the basics of tenses

THEORY

UNIT	TITLE	PERIODS
1	**Basic Alphabets**	**11**

Vowels-Consonants: Vocal Tract-Consonants: Voicing & Aspiration-Hindī Consonants 1-Hindī Consonants 2-Alphabetic Order and Transliteration Conventions for Devanagari

UNIT	TITLE	PERIODS
2	**Grammar I**	**11**

Tenses-types of Tenses

UNIT	TITLE	PERIODS
3	**Poetry and Translation**	**11**

मेरी रेल - चिचिय ोंं के थे बच्चे िार - चिलिी रानी बिी सयानी - छुक छुक करिी रेलगा़िी - आओ हम सब झूला झूलें - एक बार चिर से जय ब ली - Translation of sentences to English.

UNIT	TITLE	PERIODS
4	**Functional Hindi I**	**11**

Identify and use conjuncts in names and house objects - use of singular/plural, masculine/feminine

UNIT	TITLE	PERIODS
5	**Language and Communication I**	**10**

Getting to know each other : recognize and write letters of names and places - identify basic sentence structure - recognize and memorize basic pharases when introduces oneself - greet each other and taking leave using appropriate cultural way - negate and affirm - ask questions with kyaa and kahaaN - use sentence structure SOV and Verb hona

TOTAL PERIODS:	**54**

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1:	The students can identify the Hindi alphabet.
CO2:	The students can speak Hindi words and phrases.
CO3:	The students can recite simple poetry.
CO4:	The students can understand Tenses and are able to compare the Hindi structure with Tamil and English structure of sentences.

TEXT BOOKS:

1	The Hindi Script and Sound System.
2	Anmol Kavitaen : Integral Publishers
REFERENCE BOOKS/RESOURCES:	
1	https://wp.nyu.edu/virtualhindi/house/
2	http://hindistartalk.lrc.columbia.edu/lesson/rathore-family-introduction/
3	http://hindistartalk.lrc.columbia.edu/lesson/rajawat-family-introduction/ (0.00 -1.05)
4	http://www.learning-hindi.com/post/1156594856/lesson-51-possessive-pronouns-part-3-%E0%A4%95-kaa
5	http://www.learning-hindi.com/post/6324812777/lesson-115-%E0%A4%AD-bhee-too-also
6	http://hindistartalk.lrc.columbia.edu/lesson/rathore-family-our-home/
7	http://www.learning-hindi.com/post/880500641/lesson-19-numbers-11-20

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH09*	**German I**	**3**	**0**	**2**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	Students should become familiar with the German language; the 4 language skills are: listening, speaking, reading writing.
2	To empower the students to use German in daily communication.
3	To build up their confidence in the usage of German.
4	Familiarize the students with social, economic and cultural life in Germany.
5	To develop the written and communicative competence of the students.
6	The students should understand basics of grammar.

THEORY

UNIT	TITLE	PERIODS
1	**'Hello' and basics**	**9**

Language acts: greet and say goodbye/introduce oneself and others/talk about oneself and others/name numbers up to 20, telephone number and e-mail address/spell them/talk about countries and languages. **Vocabulary:** numbers from 1-20/countries and languages. **Grammar:** question/statement/verbs and personal pronouns. **Pronunciation:** alphabet. **Regional studies:** Countries and languages. **Film:** Good afternoon/The telephone number/I speak. **Deepening:** Advantages of learning German.

UNIT	TITLE	PERIODS
2	**'Friends, colleagues and me'**	**9**

Language acts: talk about hobbies/date/name days of the week/talk about work, professions and working hours/name numbers from 20 onwards/talk about seasons/create a profile on the internet. **Vocabulary:** hobbies/weekdays/numbers from 20/occupations/months and seasons. **Grammar:** articles/verbs and personal pronouns II/yes/no questions/plural of nouns/the verbs 'have' and 'be'. **Pronunciation:** sentence melody, questions and answers. **Regional studies:** Seasons and typical hobbies. **Film:** The trainee. **Deepening:** Principles of living together.

UNIT	TITLE	PERIODS
3	**'In the city'**	**9**

Language acts: Naming places and buildings/asking questions about places/assigning texts to a picture story/asking about things/naming means of transport/asking for directions and describing a route/understanding texts with international words/learning articles. **Vocabulary:** places and buildings/means of transport/directions. **Grammar:** definite, indefinite and negative article/imperative with 'Sie/you'. **Pronunciation:** long and short vowels. **Regional studies:** Sights, numbers, events in Hamburg. **Film:** Taxi ride/in the Hotel. **Motivation:** vision, goal setting.

UNIT	TITLE	PERIODS
4	**'Enjoy your meal'**	**9**

Language acts: talking about food/planning a purchase/conversing while shopping/conversing while eating/understanding texts with W-questions/ordering and leaning words. **Vocabulary:** meals/food/drinks/shops. **Grammar:** positions in a sentence/accusative/verb with accusative case. **Pronunciation:** Umlauts ä, ö, ü. **Regional studies:** Food in D-A-CH, professions related to food. **Film:** Breakfast/shopping. **Motivation:** plan progress

UNIT	TITLE	PERIODS

5	**'Day by day' & 'Time with friends'**	**18**
Language acts: understanding and telling the time/talking about the family/arranging an appointment/excusing oneself for being late/arranging an appointment by phone. **Vocabulary:** daily routine/time/family. **Grammar:** telling time with 'am, um, von…bis'/possessive article/modal verbs. **Pronunciation:** Hearing and speaking 'r'. **Regional studies:** Punctuality in D-A-CH. **Film:** You never have time! **Motivation:** Progress diary.		
Language acts: planning something together/talking about birthdays/understanding and writing an invitation/ordering and playing at a restaurant/talking about an event/finding specific information in texts/understanding event tips on the radio. **Vocabulary:** leisure activities/food/drinks/properties/events. **Grammar:** dates 'on..'/separable verbs/prepositions for + accusative/personal pronouns in accusative. **Pronunciation:** ei, eu, au. **Regional studies:** Pubs & Co. in D-A-CH. **Film:** Work? In the restaurant. Surprise! **Deepening:** Diversity of living together. Summarize course experiences. Write a short report.		
		54
COURSE OUTCOMES:		
Upon completion of this course, students will be able to:		
CO1:	Communicate in a simple way in German	
CO2:	Understand and use part of the basis of German grammar	
CO3:	Understand the social and cultural life in Germany in a rudimentary way, reflect on it comparatively also with others and exchange mails about it	
CO4:	Orientate themselves in the country and in the public sphere	
CO5:	Focus on own motivation and set goals	
CO6:	Communicate in German orally and in writing.	
CO7:	Refer to the dictionary for synonymous expressions and grammar.	
CO8:	Enlarge the vocabulary and understand the structure of sentences	
CO9:	To write a short report about their course experience and read it to each other	
TEXT BOOKS:		
1	Netzwerk, Deutsch als Fremdsprache A1.1, A1.2, Kursbuch plus Audio CD, workbook, Intensive trainer,Test booklet with audio CD, Klett Verlag	
2	Network of the course book with digital media (film, interactive blackboard pictures), teaching for online exercises, Facebook profile for country studies and communication	
3	Moodle	
REFERENCE BOOKS:		
1	Dictionary German-English, App	
2	Lingolia Deutsche Grammatik, App	
3	Deutsche Grammatik einfach erklärt, Easy Deutsch A1-B2 https://easy-deutsch.de/deutsche-grammatik-pdf/	
4	Woxikon, Online Synonym-Wörterbuch, https://synonyme.woxikon.de/	
5	Unterwegs Deutsch lernen, Deutschtrainer A1-App https://goethe.de/de/spr/ueb/dt1.html	

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVG03	**PRODUCTION TECHNOLOGY LABORATORY –I**	**0**	**0**	**8**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

MANUFACTURING TECHNOLOGY LAB - I

LIST OF EXPERIMENTS

1. Turning between centers
2. Eccentric Turning
3. Square thread cutting and Knurling
4. Multi start thread cutting
5. Shaping Machine: V – shaping
6. Hexagonal Head Shaping
7. Drilling and Tapping
8. Spur Gear Milling
9. Helical Gear Milling
10. Study Slot Making using slotter.

METALLURGY LABORATORY

LIST OF EXPERIMENTS

1. Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids.
2. Material identification of, say, 50 common items kept in a box.
3. Specimen preparation for metallographic examination /micro structural examination- cutting, grinding, polishing, etching.
4. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
5. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
6. Study of Microstructure and hardness of steel at different rates of cooling, Microstructure examination of white cast iron.

TOTAL PERIODS:	**144**

REFERENCE BOOKS:

1	Kalpakjain S, Schimd S, “Manufacturing Engineering and Technology”, Pearson Education, 7th edition, New Delhi, 2018.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVG04	BASIC ELECTRICAL & ELECTRONICS LAB	0	0	6	0	3

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

1. Study of tools and accessories
2. Study of joints
3. Staircase wiring
4. House wiring
5. Energy meter connection single phase and three phase system
6. Tube Light and Fan connection
7. Two way switch connection
8. Ceiling fan coil winding
9. Load calculation
10. Back up and capacity calculation of inverter

ELECTRONICS LAB

1. Rectifiers Construction of half wave and full wave rectifiers with and without filters – Calculation of ripple factors.
2. Frequency Response of RC Coupled Amplifiers Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.
3. Verification of Kirchoff's Voltage and Current Laws Determine the voltage and current in given circuits using Kirchoff"s laws theoretically and verifies the laws experimentally.
4. Study of CRO
5. VI characteristics of MOSFET and IGBT
6. Characteristics of transistor in CB, CE, CC configurations
7.Measurement of AC and DC voltages
8.Frequency and phase measurements (using Lissajou's figures)

TOTAL PERIODS:	**54**

REFERENCE BOOKS:

1	George Kennedy and Bernard Davis, Electronics communication Systems, Tata McGraw-Hill Ltd, New Delhi, 2007.
2	D.P.Kothari and I.J.Nagrath, Theory and Problems of Basic Electrical Engineering, PHI Learning. New Delhi.
3	2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi,

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH10	**APPLIED CHEMISTRY**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:
NIL / Course Code – Course Title / Topics

Course Objective	
1	To learn the fundamentals of Modern chemical lab, glassware,
2	To know about different types of Modern instruments used in chemical lab
3	To learn about various Solution preparation,
4	To learn the fundamentals of Green chemistry
5	To learn about modern chemistry systems

THEORY		
UNIT	**TITLE**	**PERIODS**
1	**INTRODUCTION IN BASIC CHEMISTRY**	**11**
Periodic table of elements-Chemistry in everyday life-Green technology & chemistry		
UNIT	**TITLE**	**PERIODS**
2	**MODERN CHEMICAL LAB & GLASSWARE**	**11**
Safety rules-Corrosive chemicals-Explosive chemicals-Chemicals storage-Waste chemicals disposal-Type of glassware-Storage & cleaning glassware-Wet chemical and dry chemicals. Lab practise and demonstration in analytical chemistry.		
UNIT	**TITLE**	**PERIODS**
3	**MODERN INSTRUMENTS USED IN CHEMICAL LAB**	**11**
Spectrophotometers (UV-vis, AAS, Infrared.)- Chromatography (TLC, Paper, GC-FID, MS) - Balances, Oven, Ventilation systems-pH, Turbidity meters, Conductivity meters. Lab Practice on Spectrophotometers, Chromatography.		
UNIT	**TITLE**	**PERIODS**
4	**SOLUTION PREPARATION**	**11**
Percentage, Molarity, Normality (Formula, definition, calculations) - Standard solutions-Glassware for preparation standard solutions-Chemical equation. Lab practice for solution preparation		
UNIT	**TITLE**	**PERIODS**
5	**INTRODUCTION TO GREEN CHEMISTRY**	**10**
Early history- 12 Principles of green chemistry- Green chemistry & sustainable development- Sources of waste generation- Types of wastes- Waste as a resource- Greening energy sources- Implementation of Green Chemistry: Real world case studies Lab Practice on Bio-diesel production from algae real field study		
	TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Know the fundamentals of Modern chemical lab, glassware,
CO2:	Know about different types of Modern instruments used in chemical lab
CO3:	Understand about various Solution preparation,

CO4:	Understand fundamentals of Green chemistry
CO5:	Know about modern chemistry systems

TEXT BOOKS:	
1	Green Chemistry for Beginners, edited by Rakesh K.Sgharma. 2021.
2	Green Materials and Environmental Chemistry New Production; Technologies, Unique Properties, and Applications. Abu Zahrim Yaser. 2021.

REFERENCE BOOKS:	
1	Laboratory Manual for Principles of General Chemistry. Jo Allan Beran. 2013

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH11	**Indian Culture and Universal Values**	**1**	**0**	**4**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
COURSE OBJECTIVES:	
1	To understand culture and learn how to know the core of a culture
2	To analyze one's relationship with region and rituals celebrated in India
3	To familiarize with Indian Mythology and learn to embody a universal value in it
4	To introduce Indian architecture through temples, its essence and its appreciation
5	To understand universal values in different culture

THEORY		
UNIT	**TITLE**	**PERIODS**
1	**Indian Culture through the exploration of Tamil Culture**	**5**
People, food, clothes; Art, music, literature, architecture, sculpture, philosophy, religion and science; Customs, traditions, and festivals		
UNIT	**TITLE**	**PERIODS**
2	**Religions in India: Exploration through Godheads & Festivals**	**5**
Origin and meaning behind Indian festivals and rituals; Worshipping the Godheads; Essence of different religions and the purpose of all religions;		
UNIT	**TITLE**	**PERIODS**
3	**Indian Cultural Symbols: Clothing & Attire**	**4**
Origin; Diversity of Indian clothing and significance; Conscious clothing		
UNIT	**TITLE**	**PERIODS**
4	**Indian Cultural Symbols: Food & Well-being**	**4**
Conception of food and eating and cooking in India; healthy and unhealthy food and food habits; Cultural practices for well-being		
	TITLE	**PERIODS**
LABORATORY		**72**
Enacting Stories from Mahabharatha and Ramayana; Embodying Values: a project Visit to an ancient architecturally rich temple; IKS (Indic Knowledge Systems) Science and art behind temples; Demonstration of Indian art and architecture-appreciation of art Create projects about food and eating and cooking in India; Create projects healthy and unhealthy food and food habits; Understanding cultural practices for well-being Create projects about origin and meaning behind Indian festivals and rituals; Projects about Worshiping the Godheads and their significance; Play on essence of different religions and the purpose of all religions		
	TOTAL PERIODS:	**90**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Relate to Indian culture and its core principles
CO2:	Explain the root of religions and rituals and rebuild one's religious personality
CO3:	Practice universal values inspired by Indian mythology
CO4:	Appreciate Indian genius in architecture and essense of Indian art and architecture

REFERENCE COURSES/BOOKS:	
1	Sri Aurobindo. National Value of Art
2	Sri Aurobindo. Foundations of Indian Culture.
3	Devdutt Pattanaik. Indian Culture, Art and Heritage.

BVGPGSH12	Course Title	Periods per week				Credits
	Integral Yoga & Values-based Life and Leadership for Human Unity- II	L	T	P	R	
		1	**0**	4	0	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

COURSE OBJECTIVES:

1	To understand and develop a consciousness-centered worldview
2	To demonstrate the major conception of Integral Yoga and the triple movements
3	To learn Radical Transformational Leadership tools to apply what I stand for (care about) in my everyday practice.
4	To learn systems thinking and design projects for cultural and systemic shifts and technical solutions in alignment.
5	To learn distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential

THEORY

UNIT	TITLE	PERIODS
1	**Consciousness-centered worldview**	**6**

Consciousness-meaning & concepts; Broad regions of Consciousness; Evolution & Involution.

UNIT	TITLE	PERIODS
2	**Integral Yoga: An Adventure of Consciousness**	**6**

Integrality; Physical, vital and mental consciousness; The psychic being; Mental evolution; Liberation and Transformation

UNIT	TITLE	PERIODS
3	**The Triple Movements**	**6**

Aspiration, Rejection and Surrender

LABORATORY **72**

(i) Integrity (being whole and undiminished)
(ii) Reviewing my BTI- CSFR and Respond & Realize
(iii) Judgment & Discernment
(iv) Synergistic Operational Strategies - Part 1(understanding)
(v) Synergistic Operational Strategies - Part 1 - Reviewing my BTI
(vi) Guilt the hidden payoff
(vii) Three domains of my Listening and speaking
(viii) Synergistic Operational Strategies - Part 2
(ix) Likert Emberling – Stages of leadership
(x) Overload and Overwhelm
(xi) Conversations for action - committed requests, committed responses.
(xii) Principled Outrage distinguished from Destructive Anger
(xiii) Transformational Results Chain (understanding)
(xiv) Transformational Results Chain and My project: Individual work

TOTAL PERIODS: 90

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1:	understand and develop a consciousness-centered worldview
CO2:	explain the major conception of Integral Yoga and the triple movements

CO3:	practice Radical Transformational Leadership tools to apply what I stand for (care about) in my everyday life.
CO4:	apply systems thinking and design projects for cultural and systemic shifts and technical solutions in alignment.
CO5:	have granularity to choose to transcend emotions and fears and work out of their full potential
REFERENCE COURSES/BOOKS:	
1	https://www.ipi.org.in/infinity/infinityfiles/0-2-2-integrality.php
2	Sri Aurobindo. Life Divine & Synthesis of Yoga.
4	Monica Sharma. (2017). Radical Transformational Leadership: Strategic Action for Change, North Atlantic Publishing, at Berkeley, California

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC09	**MECHANICAL MEASUREMENTS AND METROLOGY**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To understand the significance of measurement in industrial applications.
2	To learn the correct procedure to be adopted to measure the dimension of the components.
3	To Identify the uses of gauges, comparators, coordinate measuring machine in industries.
4	To Study various methods and handling of geometric form like flatness, roundness, thread, gear measuring instruments
5	To understand measurements of field variables like force, torque and pressure and Comprehend the fundamentals of thermo-couple and strain measurement.

THEORY

UNIT	TITLE	PERIODS
1	**BASICS OF MEASUREMENTS**	**14**

Standards - National, Reference, Secondary, and Working Standards, Line and End Standards, The process of measurement- significance, generalized measuring system Characteristics of measuring instruments: Static characteristics - Precision, Accuracy, Sensitivity, Repeatability, Reproducibility, Linearity, interchangeability, Bias, Calibration, calibration of machine tools Traceability, Confidence level. Errors- Systematic and Random, Uncertainty of Measurement

UNIT	TITLE	PERIODS
2	**LINEAR, ANGULAR MEASUREMENTS AND GAUGE INSPECTION**	**14**

Linear Measurements: Calipers, Height gauge, Depth gauge, Micrometer, Sine Bar, Bevel protractor, Sprit level, Slip gauges, Comparators: Mechanical, Electrical, Optical, Pneumatic comparators, Tolerance: Limits and fits, Types of gauges: Snap gauge, Plain plug gauge, ring gauges, Radius gauges, Feeler gauges - Gauge design

UNIT	TITLE	PERIODS
3	**SURFACE MEASUREMENT AND ADVANCED METROLOGY**	**14**

Principle, terminology and methods of measuring Straightness, flatness, roundness, Surface Finish, Measurement of screw thread elements – major diameter, minor diameter, effective diameter, pitch, Measurement of gear elements – run out, pitch, profile, lead, backlash, Advanced Metrology: Auto collimator, Laser interferometer, Coordinate measuring machine (CMM), Machine vision for metrology.

UNIT	TITLE	PERIODS
4	**MOTION, FORCE AND TORQUE MEASUREMENTS**	**15**

Measurement of motion: Displacement Measurement-Resistive, inductive-LVDT, capacitive, piezo electric, hall effect sensor, Speed measurement: optical encoders, tacho generators. Acceleration measurement: Seismic type, Piezo electric type Accelerometers. Measurement of Force and Torque: Strain gauge factor, mechanical strain gauge, electrical strain gauge, platform balance, load cell, cantilever beams, torsion bar dynamometer, servo controller dynamometer, absorption dynamometer.

UNIT	TITLE	PERIODS
5	**FLOW, PRESSURE AND TEMPERATURE MEASUREMENTS**	**15**

Measurement of Flow: Differential Pressure Meters, Rota meters, Turbine Meters, Electromagnetic Flow meters, and Ultrasonic Flow meters. Measurement of Pressure: Dead-Weight Tester, Bourdon-tube pressure gauges, Diaphragm and Bellows Gages. Measurement of Temperature: Bimetallic strip, liquid in glass thermometer, Resistance Temperature Detectors, Thermistor, Thermocouples, Pyrometers.

TOTAL PERIODS:	**72**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Ability to understand the significance of measurement in industrial applications.
CO2:	Understanding the correct procedure to be adopted to measure the dimension of the components.
CO3:	Identify the uses of gauges, comparators, coordinate measuring machine in industries.
CO4:	Study various methods and handling of geometric form like flatness, roundness, thread, gear measuring instruments
CO5:	Interpret measurements of field variables like force, torque and pressure and Comprehend the fundamentals of thermo-couple and strain measurement.

TEXT BOOKS:	
1	Jain R.K. —Engineering Metrology‖, Khanna Publishers, 2009.
2	Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.
3	Venkateshan, S. P., —Mechanical Measurements‖, Second edition, John Wiley &Sons, 2015.
REFERENCE BOOKS:	
1	Backwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2006.
2	Raghavendra N.V. and Krishnamurthy. L., Engineering Metrology and Measurements, Oxford University Press, 2013.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH13	**INDUSTRIAL MANAGEMENT AND PROFESSIONAL ETHICS**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To understand the management process in industry
2	To understand the difference between private and public sectors.
3	To know laws in industrial area
4	To enable the students to create an awareness on Engineering Ethics and Human Values.
5	To instil Moral and Social Values and Loyalty and to appreciate the rights of others.

THEORY

UNIT	TITLE	PERIODS
1	**INTRODUCTION ABOUT MANAGEMENT**	**14**
Growth of industry - The management of men, materials and machines, the art of management, Sources of capital- industrial individual enterprise, private partnership and private Ltd. Co., Joint Stock Co. shares, debentures, financial agencies and their role in promoting industries. Break even analysis.		
UNIT	**TITLE**	**PERIODS**
2	**PRIVATE SECTOR AND PUBLIC SECTOR**	**14**
Public sector enterprise - merits and demerits of public sector industry and private sector industry, Line, staff and functional organizations, reasons for the choice of various types of organization, functions of different departments (stores, purchase and sales), departments relationship between individual departments.		
UNIT	**TITLE**	**PERIODS**
3	**ENGINEERING ETHICS**	**14**
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.		
UNIT	**TITLE**	**PERIODS**
4	**LABOUR, INDUSTRIAL & TAX LAWS**	**15**
Evolution of industrial law, factory act, workmen compensation act, payment of wages act, employee's state insurance act, Industrial dispute act. Role of technician in industry: Position of technician in various engineering departments, Role of a supervisor in industry, Foremanship, duties and qualities of a good foreman.		
UNIT	**TITLE**	**PERIODS**
5	**HUMAN VALUES**	**15**
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.		
	TOTAL PERIODS:	**72**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	understand the management process in industry
CO2:	Understand the difference between private and public sectors.

CO3:	know laws the industrial area
CO4:	Create an awareness on Engineering Ethics and Human Values.
CO5:	Discuss the ethical issues related to engineering and realizing the responsibilities and rights in the society
TEXT BOOKS:	
1	Khanna, O.P. - Industrial Engineering and Management, Khanna Publishers, New Delhi.
2	Martand Telsang - Industrial and Business Management, S.Chand & Co., 2001
REFERENCE BOOKS:	
1	Jain, K.C. and Agarwal, L. N. – Production Planning Control & Industrial Management, Khanna Publishers, New Delhi.
2	Banga, Sharma & Agrawal, Industrial Engineering & Management Khanna Publishing

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH14*	**HINDI II**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To introduce the students to Hindi Alphabet and To encourage the students to speak Hindi
2	To enable students to use Hindi in day-to-day communication
3	To build up their confidence in the usage of Hindi
4	To expose them to light prose
5	To introduce them to the basics of Grammar

THEORY

UNIT	TITLE	PERIODS
1	**Sentences and Translation**	**11**

Hindi Phrases and Sentences (Identifying and Writing) -Sentences Translation from English.

UNIT	TITLE	PERIODS
2	**Grammar II**	**11**

Tenses - Adjectives - Singular/ Plural - Nouns and Genders

UNIT	TITLE	PERIODS
3	**Prose**	**11**

Simple Prose's from the prescribed prose book -(1 to 5 prose)

UNIT	TITLE	PERIODS
4	**Functional Hindi I**	**11**

Communication (About Daily Routines, Various Daily Activities, Time, Name of the days in a week) - Use of Noun adjective agreements, feminine and masculine - Use personal pronouns in direct and oblique forms - Use of present habitual - Use of reflexive Pronouns (apnaa, khud) - Use of Numbers (1-80) - Learning about what their peers and their heroes do everyday - Communication on roommate routine and Preferences.

UNIT	TITLE	PERIODS
5	**Language and Communication II**	**10**

Where am I From? :about where people are from - personal information - name and identify relatives - express possession with kinship terms (kaa/ke/kii) - about age - use interrogative pronouns (kaun, kiskaa, kiskii, kiske, kahaaN se) - use possessive pronouns - use past habitual tense - use of numbers (1-70) - use emphatic hii and bhii

TOTAL PERIODS:	**54**

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1:	The students can identify the Hindi alphabet and make phrases and sentences.
CO2:	The students can speak and understand simple phrases and sentences of day to day conversation in Hindi.
CO3:	The students can read stories written in simple Hindi.
CO4:	The students can familiar with the basics of grammer- senctence construction, Sanghya, Saravanaam, Visheshan, Kriya, Sambandhbodhak, etc.,

TEXT BOOKS:	
1	The Hindi Script and Sound System.
REFERENCE BOOKS:	
1	https://learningmole.com/hindi-alphabet-letters-pronunciation-guide/
2	http://www.learning-hindi.com/post/853847321/lesson-15-pronouns
3	http://www.learning-hindi.com/post/1222427011/lesson-57-what-time-is-it
4	http://www.learning-hindi.com/post/1162464592/lesson-52-possessive-pronouns-part-4-%E0%A4%85%E0%A4%AA%E0%A4%A8-apnaa
5	http://hindistartalk.lrc.columbia.edu/lesson/rajawat-family-introduction/ (0.00 - 1.05)
6	http://www.learning-hindi.com/post/1156594856/lesson-51-possessive-pronouns-part-3-%E0%A4%95-kaa
7	http://www.learning-hindi.com/post/880500641/lesson-19-numbers-11-20
8	http://www.learning-hindi.com/post/6324812777/lesson-115-%E0%A4%AD-bhee-too-also
9	http://hindistartalk.lrc.columbia.edu/lesson/rathore-family-our-home/
10	http://hindistartalk.lrc.columbia.edu/lesson/rathore-family-introduction/

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH14*	**German II**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	The course aims to achieve competence according to the scales of the Common European Framework of Reference for Languages, in the four linguistic skills – speaking, listening, reading, and writing. The students will be dealt with in an everyday and balanced way, and grammatical phenomena will be analysed and explained.
2	The course content aims at understanding and possible participation in social, economic, and cultural life in Germany and helps students to assess living situations in Germany and to find their way in everyday, professional and university areas as well as with the authorities.
3	To build students confidence through various methods such as democratic teaching style,inclusion of the students' world of life and experience, progress diary, information and protocol techniques, mind mapping, think-pair-share, communication, discussion and facilitation techniques, etc.
4	The teaching of values and orientation knowledge is a special aspect of this German course 2. The aim is to discover cultural differences and similarities. Values such as respect, tolerance, helpfulness, responsibility, reliability, honesty, politeness, and a sense of order will be focused on.
5	Another focus will be 'Motivation to learn', i.e., students will learn to set goals, track their progress, and learn deal with setbacks.
6	Project work and business games play an important role in preparing students for their future professional tasks. In this way, theycan use their existing linguistic, methodological, and professional knowledge even at this language level to realize a project, plan it, search for it,carry it out and present it. This gives room for self-directed, creative, experimental workand learning in the group.

THEORY

UNIT	TITLE	PERIODS
1	**Communication: Coversation on phone & official letters , Communication: Searching for an apartment to rent and Communication at work place**	**11**

Language actions: Making appointments/understanding and giving instructions/Understanding and answering letters/talking about language learning/finding information in texts/recognizing situations in conversation/understanding conversations. Vocabulary: everyday office life/telephone/letter standards/language learning. Grammar: prepositions with dative/articles in dative/possessive Articles: Accusative. Pronunciation: Long and short 'e'.Regional studies: Social networks in D-A-CH. Film: In the company/How does it work? Motivation: Make a promise to yourself. **Language activities**: Understand flat advertisements/describe a flat/plan the flat furnishing/answer an invitation in writing/talk about a flat furnishing/express liking and disliking/talk about forms of housing/write a text about a flat. Vocabulary: flat/rooms/furniture and devices/colours/housing styles. Grammar: Adjective with 'to be' (+very/to) #in' with accusative/adjective prepositions with dative case. Pronunciation: s and sh. Regional studies: Types of housing in D-A-CH. Film: My flat/How to find a flat? Knowledge of values and orientation: 'Living and neighbourhood', living together and house rules, quiet times, night's rest, politeness. . **Language acts:** describing a daily routine/talking about the past/understanding job advertisements/expressing opinions about jobs, understanding blogs about jobs/preparing a telephone conversation, making phone calls, and asking questions/talking about jobs. Vocabulary: professions and places of work/study/jobs. Grammar: Perfect/Participle II: combining regular and irregular verbs/sentences: 'and, or, but'. Pronunciation: listening to and speaking h. Regional studies: Seasonal jobs in D-A-CH. Film: Felix's day/student jobs. Knowledge of values and orientation: 'World of work and economy', working and paying taxes,

compulsory insurance pensions-health insurance-unemployment benefit, dealing with money.		
UNIT	**TITLE**	**PERIODS**
2	**Shopping&health: Clothes and fashion and Shopping & health: Healthy and lively**	**11**
Language acts: talking about clothes/understand a chat about a purchase/talking about the past/have conversations when shopping for clothes/finding your way around the department stores/understand and research information about Berlin. Vocabulary: clothes/floors and goods in a department store/shops and stores. Grammar. 'Which one? Which? This one; that one; these'/participle II: separable and non-separable verbs/personal pronouns in the dative case. Pronunciation: stressing verbs with prefixes. Regional studies: Trendy city Berlin. Film: Can I h help you? I'll try it on! Motivation: Prepare for possible setbacks. **Language acts:** giving personal details/naming body parts/understanding and explaining a sports exercise/reproducing requests/conducting conversations at the doctor's office/understanding and giving instructions/understanding and giving health tips/inferring words. Vocabulary: body parts/body care/illnesses/medications/jobs. Grammar: imperative/demand sentences/'should, must, must not, may'. Pronunciation: p and b, t and d, k and g. Regional studies: Home remedies for illnesses. Film: Washing hair/The accident. Knowledge of values and orientation: 'Health', health care system, solidarity principle, and family doctor comes before hospital, emergency, precaution, prevention.		
UNIT	**TITLE**	**PERIODS**
3	**Travelling and going out: on vacation! , Travelling going out: booking at Restaurant**	**11**
Language actions: Understand suggestions for a city tour/describe a route/write a postcard/describe the weather/understand travel reports/describe problems in the hotel/complain in the hotel/talk about travel destinations. Vocabulary: types of holidays and destinations/sightseeing/weather. Grammar: Pronouns: 'man'/Questions words: 'Who? Whom? What?' Adverbs of time: 'first, then, later, at the end'. Pronunciation: f/v/w. Regional studies: Popular travel destinations in Germany. Film: Packing your suitcase/How was it? Motivation: Celebrate the positive and thank helpers. **Introducing** yourself/reporting about the past/getting an appointment/understanding information on a homepage/booking a restaurant. Vocabulary: leisure, activities, in a restaurant. Grammar: Genitive: name + s/repetition: perfect/subordinate clause with 'because'.Pronunciation: 'ch'. Strategy: Learning words with all senses. Regional studies: Eating without light. Network-flat share community: That's us. We brought something with us.		
UNIT	**TITLE**	**PERIODS**
4	**Social: After school time , Social: Expressing feelings and Social: Living in the city**	**11**
Understanding reports from school days/talking about school days/writing comments/understanding a radio programme, talking about experiences7speaking one's own mind/presenting something. Vocabulary: school experiences, school subjects, types of school. Grammar: modal verbs in the past tense, repetition: articles/possessive articles in the dative case Pronunciation:'e'. Strategy: learning important phrases by heart. Regional studies: Types of school in Germany. Network-flat-sharing community: The school project. Knowledge of values and orientation: Friendships **Talking** about feelings/expressing congratulations/expressing thanks/expressing joy or regret/talking about an event7understanding and writing blogs. Vocabulary: celebrations, events, feelings, congratulations, thanks. Grammar: subordinate clause with 'if', reflexive verbs. Pronunciation: emotional speech. Strategy. Structuring texts. Regional studies. A festival in the north. I feel at home here. Network-flat-sharing community: Bad mood/Everything will be fine! The message. Knowledge of values and orientation: Stress and mental health. **Understanding** a job interview/asking for things/understanding conversations at banks and authorities/asking politely for something/following a city tour/describing a city Vocabulary: city, job interview, bank, authority. Grammar: adjectives after the definite article/prepositions 'without' + accusative and 'with' dative/subjunctive II: 'could'. Pronunciation: friendly requests. Strategy: imagining a situation. Regional studies: around the ring: Vienna. Network-flat-sharing community: A job for Max/The trial job. Motivation: thanking yourself, sharing it with others.		
UNIT	**TITLE**	**PERIODS**

5	**Working worlds: Always online?, Working worlds: Career**	**10**
Talking about advantages and disadvantages/formulating comparisons/doing an interview. Understanding opinions in texts/expressing one's own opinion/talking about films/understanding film descriptions/describing a film/understanding and writing comments on a film.Vocabulary: media, activities with media, film. Grammar: Adjectives. Comparative and superlative, comparisons with 'as' and 'how' subordinate clause with 'that'. Pronunciation: 'b' or 'w'. Strategy: reading long texts. Regional studies: Cinema! Cinema! Network-flat-sharing community: Do you have time? Wait a minute! Picnic in the park. Knowledge of values and orientation: Advantages and disadvantages of the internet. **Conducting** a conversation at the ticket counter/Telling information from texts/Expressing career wishes/Writing about a dream job/Preparing a telephone conversation/Transmitting information from a text. Vocabulary: activities at work, travelling by train, on the phone. Grammar: adjectives after the indefinite article/'to become'. Pronunciation: 'm' or 'n'. Strategy: Talking on the phone in German. Regional studies: The modern world of work. Network-flat-sharing community: When are we going? The taster course. Knowledge of values and orientation: Extension: 'Working world and economy'		
	TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Understand the basics of German grammar.
CO2:	Have increased vocabulary knowledge.
CO3:	Focus on their own motivation, set goals and check them, follow them up (progress diary) and deal with possible setbacks.
CO4:	To understand the social, cultural and economic life in Germany and to be able to reflect with others on the respective values in a comparative way.
CO5:	Read, listen and understand better.
CO6:	Communicate orally and in writing in German.
CO7:	Be able to refer to a dictionary, synonym dictionary and use language apps/websites.
CO8:	To be able to realise a small project, plan it, look for it, carry it out and present it.
CO9	To be more self-confident.
TEXT BOOKS:	
1	Netzwerk neu, Deutsch als Fremdsprache, A1, A2, Klett Verlag Kursbuch plus audios and videos Workbook plus audio CD Intensive trainer Test booklet with audio CD
2	Audio files for download, Klett-Augmented-App
3	Facebook profile for country studies and communication https://www.facebook.com/goetheinstitut.deutsch
4	YouTube, 24 Stunden Deutsch/Goethe Institut:https://www.youtube.com/24hdeutsch
5	Goethe Institute, Online-Spiele& Quiz, https://www.goethe.de/de/spr/ueb.html
REFERENCE BOOKS:	
1	Dictionary German-English, App
2	Lingolia Deutsche Grammatik, App
3	Deutsche Grammatik einfach erklärt, Easy Deutsch A1-B2 https://easy-deutsch.de/deutsche-grammatik-pdf/
4	Woxikon, Online Synonym-Wörterbuch https://synonyme.woxikon.de
5	Unterwegs Deutsch lernen, Deutschtrainer A2-App
6	Es ist nie zu spät, erfolgreich zu sein, Ben Furman, TapaniAhola, Carl-Auer-Verlag
7	Dowling,Dave Oxford Guide To Effective Writing And Speaking

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC10	PRODUCTION TECHNOLOGY LABORATORY- II	0	0	8	0	4

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

List of Experiment:

1.Calibration and use of measuring instruments – Vernier caliper, micrometer, Vernier height gauge using gauge blocks.
2. Calibration and use of measuring instruments – depth micrometer, bore gauge.
3. Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
4. To measure the diameter of a hole with the help of precision balls.
5. To measure external and internal taper with the help of taper gauges, precision rollers.
6. Measurement of screw thread parameters using Floating carriage micrometer
7.Measurement of gear tooth thickness using gear tooth vernier caliper.
8. Measurement of Displacement using LVDT and RVDT.
9. Study and sketch of various types of optical projectors.
10. Study and sketch of various types of comparators and use them for comparing length of given piece.
11. To measure the straightness of the edge of a component with the help of auto-collimeter.
12. To test the squareness of a component with auto-collimeter.
13. Study of a tool maker's microscope.
14. Checking of accuracy of snap gauge with slip gauge.
15. Checking of accuracy of a plug gauge with micrometer.

MACHINE DRAWING USING CAD SOFTWARE

PART – A

1. CONVENTIONAL REPRESENTATION - Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs; Introduction to SOLIDWORKS software.
2. SECTIONAL VIEWS - Types of sections, selection of section planes and drawing of sections and auxiliary sectional views, parts not usually sectioned.
3. DIMENSIONING - Methods of dimensioning, general rules for sizes, and placement of dimensions for holes, centers, and curved and tapered features.
4. INTRODUCTION TO GEOMETRICAL TOLERANCE -Component drawing assigning fits and tolerance machine symbol, surface finish - Introduction to Production drawing and concepts of P-7 drawing.

PART – B

1. Preparation of drawings of parts and assembly of machine elements and simple parts; Selection of orthogonal views and additional views for the following machine elements and parts with every drawing proportion, popular forms of screw threads, bolts, nuts, stud bolts.
2. BOLTS – Hexagonal and Square Head Bolt
3. JOINTS - Riveted joints - butt joints and lap joints
4. KEYS AND COTTER JOINT - Cotter joints -sleeve, socket and spigot joints - Pin joints - knuckle joints
5. COUPLINGS - Split muff couplings, flexible type flange coupling, universal coupling
6. BEARING - Pedestal bearing, swivel bearing, Plumber block
7. AUTOMOBILE COMPONENT - Screw jack and Connecting rods
8. Lathe tail stock
9. Steam stop valve.

TOTAL PERIODS:	**54**

REFERENCE BOOKS:

1	Gupta, I.C., "Engineering Metrology", Dhanpat Rai Publications (P) Ltd., 2003.
2	K.L. Narayana, P. Kannaiah, K. Venkata Reddy, "Machine Drawing", New Age Publishers, 3rd Edition, 2012.
3	N. D. Bhatt, V. M Pancahal, "Machine Drawing", Charotar, 2014
4	R. K. Dhavan, "A Text book of Machine Drawing", S.Chand Publication & Co, New Delhi, 2 nd Edition, 2008
5	K.C. John, "Text book of Machine Drawing", PHI Eastern Economy, 1 st Edition, 2010.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH16	**Integral Yoga & Values-based Life and Leadership for Human Unity- II Refresher and Application**	**1**	**0**	**4**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
COURSE OBJECTIVES:	
1	To incorporate aspects of integral yoga into life with meditation and reflection
2	To incorporate aspects of integral yoga into life with suryanamaskar
3	To integrate Radical Transformational Leadership tools in everyday practice.
4	To design projects for system and cultural shift from universal values
5	To learn distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential

THEORY

UNIT	TITLE	PERIODS
1	**Review of the triple movement**	**9**
Aspiration, Rejection and Surrender		
UNIT	**TITLE**	**PERIODS**
2	**RTL (Radical Transformational Leadership) Book Reading**	**9**
Understanding the praxis around the world around RTL		

LABORATORY

UNIT	TITLE	PERIODS
1	**Meditation**	**14**
To learn and incorporate daily meditation		
UNIT	**TITLE**	**PERIODS**
2	**Suryanamaskar**	**14**
To learn and incorporate suryanamaskar		
UNIT	**TITLE**	**PERIODS**
3	**Reflection**	**10**
To reflect weekly on the progress made physically and mentally		
UNIT	**TITLE**	**PERIODS**
4	**Refresher and triad practice**	**18**
Reflection on the tools applied in day to day life. Conversations for clarity and refreshers.		
UNIT	**TITLE**	**PERIODS**
5	**Design and implementation of breakthrough initiative**	**16**
Refresher on design templates and design and refining the breakthrough initiative at college.		
	TOTAL PERIODS	**90**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
1	Develop in meditation and reflection
2	Develop physically through suryanamaskar

3	Use Radical Transformational Leadership tools in everyday practice.
4	Design projects for system and cultural shift from universal values
5	Notice distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential
REFERENCE COURSES/BOOKS:	
1	Altered Traits: Science Reveals How Meditation Changes Your Mind, Brain, and Body- Daniel Goleman and Richard Davidson
2	Monica Sharma. (2017). Radical Transformational Leadership: Strategic Action for Change, North Atlantic Publishing, at Berkeley, California

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC11	PRODUCTION AUTOMATION & COMPUTER INTEGRATED MANUFACTURING.	4	0	0	0	4

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To understand the fundamentals of automation in manufacturing process.
2	To produce goods services of right quality and quantity at the predetermined time and pre-established cost.
3	To design an assembly line with the maximum balancing efficiency or with the minimum balance delay.
4	To maximize production efficiencies by grouping similar and recurring problems or tasks.
5	To learn how the AGVs are extensively used in FMSs because of their flexible structure and high compatibility

THEORY

UNIT	TITLE	PERIODS
1	**FUNDAMENTALS OF MANUFACTURING AND AUTOMATION**	14

FUNDAMENTALS OF MANUFACTURING AND AUTOMATION: Definition, Scope, its types and their merits, reasons for automation, its appreciation and criticism, Meaning of the term Computer Integrated Manufacturing (CIM/CAD/CAM) Relationship between CIM and Automation Types of Industries- Manufacturing, Processing; Basic producers, Converter, Fabricators. Types of Production - Manufacturing - Functions - Processing - Basic processing, Secondary processing; Operations enhancing physical properties and finishing operations, Assembly, Material handling and Storage; Inspection and test and control, their meaning with automation point of view, Automation of welding Manufacturing Process Inputs - Raw materials, Equipment's (Machine Tools), Tooling and fixtures, Energy and Labour, Outputs - Finished product and Scrape/Waste.

UNIT	TITLE	PERIODS
2	**PRODUCTION CONCEPT**	14

PRODUCTION CONCEPT: Manufacturing Lead Time (MLT), Production rate, Components of Operation Time, Production Capacity (PC), Utilisation and availability, Work in Process (WIP), Time in Plant (Tip), WIP Ratio, Tip ratio, their meaning and significance. Simple numerical problems Automation Strategies and Their Effect - Specification of operation, Combined operations, Simultaneous operations, Integration operations, Increase flexibility, Improved material handling and storage, on-line inspection, process control and optimization, Plant operation control, computer integrated manufacturing. PRODUCTION ECONOMICS: Methods evaluation investment alternatives, Constraints in manufacturing, Break Even Analysis, Unit Cost of Production, Cost of manufacturing, lead time and work in process.

UNIT	TITLE	PERIODS
3	**ASSEMBLY SYSTEM AND LINE BALANCING:**	14

ASSEMBLY SYSTEM AND LINE BALANCING: The assembly process, Assembly system, Manual assembly lines, Line balancing problems, Computerised line, balancing methods, other ways to improve the line balancing, flexible manual assembly line
AUTOMATED ASSEMBLY SYSTEMS: Design for automated assembly, Types of automated assembly systems, Parts feeding devices, analysis of multi-station Assembly machines, Analysis of single station assembly machines

UNIT	TITLE	PERIODS
4	**GROUP TECHNOLOGY**	15

Group Technology and Cellular Manufacturing, Parts Classification and Coding, Production Flow Analysis, Cellular Manufacturing. Industrial Robotics: Robot Anatomy and Related Attributes, Robot Control Systems, Robot Applications.		
UNIT	**TITLE**	**PERIODS**
5	**FLEXIBLE MANUFACTURING SYSTEM AND AUTOMATED GUIDED VEHICLE**	**15**
Definition and Broad Characteristics of Flexible Manufacturing Cells, Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control – Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.		
	TOTAL PERIODS:	**72**
COURSE OUTCOMES:		
Upon completion of this course, students will be able to:		
CO1:	Understand the fundamentals of automation in manufacturing process.	
CO2:	Know how to produce goods services of right quality and quantity at the predetermined time and pre-established cost.	
CO3:	Design an assembly line with the maximum balancing efficiency or with the minimum balance delay.	
CO4:	Maximize production efficiencies by grouping similar and recurring problems or tasks.	
CO5:	Know how the AGVs are extensively used in FMSs because of their flexible structure and high compatibility.	
TEXT BOOKS:		
1	Mikel P.Grover, Automation, Production Systems and Computer Integrated Manufacturing, PHI Ltd., New Delhi, 2003.	
2	P. Radhakrishnan and S. Subramanian – CAD/CAM/CIM/, Wiley Eastern Ltd., 2000.	
REFERENCE BOOKS:		
1	P.N. Rao et al, Computer Aided Manufacturing, Tata McGraw Hill Publishers, 1993.	
2	G.Boothroyd et al, Automatic assembly, Marcel Dekker Inc., New York, 1993.	

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC12	CAD & CAM	4	0	0	0	4

PREREQUISITES:
NIL / Course Code – Course Title / Topics

Course Objective	
1	To learn the basics of computer aided design of the product
2	To identify whether a figure has been reflected, rotated, or translated, label corresponding points on the image of a polygon following a transformation, perform a simple transformation on a grid given a coordinate transformation
3	To learn how to create the new or improve upon existing manufacturing setups to boost efficiency and reduce wastage.
4	To learn how to create a prototype by cutting a block of material into a specific shape.
5	To learn the Part Programming

THEORY

UNIT	TITLE	PERIODS
1	**FUNDAMENTALS OF CAD**	**14**

Fundamentals of CAD – Introduction, Design Process, Application of Computers in Design, Benefits of CAD, Computer Hardware, Graphic Input Devices, Display Devices, Graphics Output Devices, CAD Software, Software Configuration of a Graphic System, Geometric modeling: Techniques: Wire frame modeling – surface modeling – solid modeling. Database Structure and Control, Graphic Standards such as GKS and IGES.

UNIT	TITLE	PERIODS
2	**GEOMETRICAL TRANSFORMATION**	**14**

Geometric Transformations - Mathematics Preliminaries, Matrix Representation of 2 and 3 Dimensional Transformation, Concatenation of Transformation Matrices, Application of Geometric Transformations, Representation of Curves and Surfaces: Polygon, Meshed and Ruled Surfaces, Bezier Curves, B-Spline Curves. Concept of Hidden-Line Removal and Shading, Kinematics Analysis and Simulation

UNIT	TITLE	PERIODS
3	**COMPUTER AIDED MANUFACTURING**	**14**

Definition, functions, benefits. Group technology – Part families - Parts classification and coding - coding structure – Optiz system, MICLASS system and CODE System - process planning – CAPP – Types of CAPP: Variant type, Generative type – advantages of CAPP – production planning and control – computer integrated production management system – Master Production Schedule (MPS) – Capacity planning – Materials Requirement Planning (MRP) –Manufacturing Resources Planning (MRP-II)

UNIT	TITLE	PERIODS
4	**CNC MACHINES**	**15**

CNC Machines: Numerical control – definition – components of NC systems – development of NC – DNC – Adaptive control systems – working principle of a CNC system – Features of CNC machines - advantage of CNC machines – difference between NC and CNC – Construction and working principle of turning centre – Construction and working principle of machining centers – machine axes conventions turning centre and machining centre – design considerations of NC machine tools.

UNIT	TITLE	PERIODS
5	**PART PROGRAMMING**	**15**

Part Programming: NC part programming – Coordinate System, Structure of a Part Program, methods – manual programming – conversational programming – APT programming - Format: sequential and word address formats - sequence number – types of motion control: point-to-point, paraxial and contouring –

Datum points: machine zero, work zero, tool zero NC dimensioning – reference points – tool material – tool inserts – tool offsets and compensation - NC dimensioning – preparatory functions and G codes, miscellaneous functions and M codes – interpolation: linear interpolation and circular interpolation.	
TOTAL PERIODS:	**72**
COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Know the basics of computer aided design of the product.
CO2:	Identify whether a figure has been reflected, rotated, or translated, label corresponding points on the image of a polygon following a transformation
CO3:	Create new or improve upon existing manufacturing setups to boost efficiency and reduce wastage.
CO4:	How to create a prototype by cutting a block of material into a specific shape.
CO5:	Know how to do the Part Programming.
TEXT BOOKS:	
1	Mikel P.Grover, Automation, Production Systems and Computer Integrated Manufacturing, PHI Ltd., New Delhi, 2003.
2	P. Radhakrishnan and S. Subramanian – CAD/CAM/CIM/, Wiley Eastern Ltd., 2000.
REFERENCE BOOKS:	
1	Sadhu Singh - Computer Aided Design and Manufacturing, II Edition, Khanna Publishers, New Delhi, 2014.
2	Ibrahim Zeid - CAD/CAM Theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2013.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVG05	BASICS OF MECHANICS	4	0	0	0	4

PREREQUISITES:

NIL / Course Code – Course Title / Topics

Course Objective

1	To learn about the basics of force and its system principle
2	To learn and analyse planar and spatial systems to determine the forces in members of trusses, frames.
3	To understand the calculation of the friction force/ torque requires to operate the machine elements.
4	To learn the basics knowledge of kinematics and dynamics of solid.
5	To learn the basics of power transmission.

THEORY

UNIT	TITLE	PERIODS
1	**FORCES AND FORCE SYSTEM**	14

Introduction – Units and Dimensions – Laws of forces — Vectorial representation of forces – Concurrent and non-concurrent coplanar forces, Conditions of static equilibrium for coplanar force system, stability and equilibrium, concept of free body diagrams. Fundamental Principles of mechanics: Principle of transmissibility, Principle of superposition, Law of gravitation, Law of parallelogram of forces. Application of Force System - Analysis of plane trusses – method of joints – method of sections.

UNIT	TITLE	PERIODS
2	**PROPERTIES OF SECTIONS**	14

Properties of Surfaces- Properties of sections – centroids, center of gravity, area moment of inertia, Parallel Axis Theorem, product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia of Basic Shapes - Experimental Determination. Principle of virtual work – work done by force and couple – application to simple mechanical systems.

UNIT	TITLE	PERIODS
3	**FRICTION**	14

Friction: Laws of friction, Static dry friction, simple contact friction problems, simple screw jack, and Belt friction, Friction clutches, rolling friction, Journal bearing and thrust bearing friction.

UNIT	TITLE	PERIODS
4	**INTRODUCTION TO KINEMATICS AND DYNAMICS**	15

Introduction to Kinematics and Dynamics, Kinematics of Particle in Rectilinear and Curvilinear Motions, Projectile, Kinematics and Kinematics of a Rigid Body. Usage of D'Alembert's Principle, Work and Energy, Impulse and Momentum Principles.

UNIT	TITLE	PERIODS
5	**POWER TRANSMISSION**	15

Pulleys, Gears & Shaft: Classification of Pulleys, Types of Belts, Simple calculation of pulley diameter, Classification of Gears, Simple calculation of number of teeth and speed, Power transmission by solid and hollow shaft

TOTAL PERIODS:	**72**

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1:	Determine the resultant force and moment for a given force system.

CO2:	Analyse planar and spatial systems to determine the forces in members of trusses, frames.
CO3:	Determine the friction force/ torque requires to operate the machine elements
CO4:	Know the basics knowledge of kinematics and dynamics of solid.
CO5:	Understand the basics of power transmission.

TEXT BOOKS:	
1	Rattan S. S., Theory of Machines, McGraw Hill Education; Fourth edition (2017)
2	Timoshenko, S., Young, D.H., Rao, J.V. and Sukumar Pati, Engineering Mechanics, Fifth edition, McGraw Hill Education (India) Pvt. Ltd., 2013.
REFERENCE BOOKS:	
1	Beer and E.R. Johnstons–Vector Mechanics, McGraw-Hill, New York
2	Shigley J. E. and John Joseph Uicker, Theory of Machines and Mechanisms, 2nd edition McGraw-Hill international edition (2003).

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH17	**Placement Training & Skill Development Program - I**	**1**	2	**0**	**0**	**3**

PREREQUISITES:		
NIL / Course Code – Course Title / Topics		
COURSE OBJECTIVES:		
1	To prepare the students write their project report	
2	Get ready to write proposals implementing their ideas	
3	To prepare them to speak in Public	
4	To make them prepare effective Presentations and Enable students in Aptitude building	
5	Enable students to use their Aptitude Knowledge effectively in decision making	
UNIT	**TITLE**	**PERIODS**
1	**Report, Proposal, and Project**	**11**
Report Writing, Types, Structure, Style, and Writing of Reports (on different topics), Characteristics of Report, Categories and Types of Report, Types of Proposal, Nature, and Significance, Structure of formal Proposal, Sample Proposal, Writing Proposals on different topics, Difference between Report and Proposal, Project Writing: Essential Features, Structure, Choosing the Subject, and Writing the Project on the related subject.		
UNIT	**TITLE**	**PERIODS**
2	**Communication Skills**	**10**
Activities related to Skills required for Engineers (Managerial Skills, Leadership Skills, and Organizational Skills). Recruitments and Interviews, Stages in Job Interview, Desirable Qualities, Reviewing the common Question Types of Interviews.		
UNIT	**TITLE**	**PERIODS**
3	**Strategies for Recruitment**	**11**
Recruitments and Interviews, Stages in Job Interview, Desirable Qualities, Reviewing the Common Question Types of Interviews.		
UNIT	**TITLE**	**PERIODS**
4	**Numbers and Arithmetic Basic**	**11**
Classification of Numbers, Divisibility rules –LCM/HCF, Remainders – Base System, Surds, Indices, Logarithms, Percentage, Profit and Loss, Ratio and Proportion, Approximations, Vedic Maths, Intro to DI, Comprehensive Practice Test on Number system, Percentage and Calculation,		
UNIT	**TITLE**	**PERIODS**
5	**Simple Arithmetic:**	**11**
Code-decoding, Analogies, Direction Test, Blood relations ,Comprehension Practice test-1 (Cumulative) ,Comprehension Practice test-2 (Cumulative)		
	TOTAL PERIODS:	**54**
COURSE OUTCOMES:		
CO1:	1. Students are trained to write the proposals and assigned projects	
CO2:	3. Students write Presentations on different Industrial topics	
CO3:	4. Improve arithmetic aptitude	
CO4:	5. Learn tricks to solve Aptitude questions faster thereby saving time during competitive exams	
REFERENCE COURSES/BOOKS:		
1	Sanjay Kumar and Pushp Lata ‘Communication Skills’, Oxford University Press 2012	
2	Raymond Murphy ‘Essential English Grammar’, Cambridge University Press 1998	
3	R. K. Narayan, Malgudi Days: A Collection of Short Stories, Penguin 2006	
4	Meenakshi Raman and Prakash ‘Business Communication’ Oxford University Press 2011	

5	Quantitative Aptitude for Competitive Examinations - Quantitative Aptitude by rs agrawal (English, Paperback, Aggarwal R. S.)
6	Meenakshi Raman and Sangeeta Sharma 'Technical Communication Principles and Practice', Oxford University Press 2012.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC13	**PRODUCTION TECHNOLOGY LABORATORY - III**	**0**	**0**	**8**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

MANUFACTURING TECHNOLOGY LAB – II

1. Study of surface grinding machine
2.Study of cylindrical grinding machine
3.Study of Tool and cutter grinder
4.Study of Gear hobbing machine.
5.Make plain surfaces (four surfaces) using surface Grinder
6.Make Progressive type Plug gauge using Cylindrical Grinding machine
7.Make a single point cutting Tool using Tool and Cutter Grinder
8.Drilling and Boring (Using Lathe Machine)
9.Make a spur gear using Gear Hobbing Machine.
10.Nano Mill

CAD & CAM LABORATORY

CAD
1. Introduction of 3D Modeling software PRO-E / SOLID WORKS /CATIA.
2. To create a part drawing for the given diagram using any one of the modeling software.
3. Creation of 3D assembly model of following machine elements using 3D Modeling software
1. Flange Coupling
2. Plummer Block
3. Swivel Bearing
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Safety Valves
9. Connecting rod
10. Piston.

CAM

1. Study of the structure of a CNC turning center
2. Study of the structure of a CNC machining center
3. Manual Part Programming
1. To prepare Manual part programming for plain turning operation.
2. To prepare part program for taper turning operation.
3. To prepare part program for turning operations using turning cycle.
4. To prepare part program for threading operation.

5. To prepare part program for slot milling operation. 6. To prepare part program for gear cutting operation. 7. To prepare part program for gear cutting using mill cycle. 8. To prepare part program for drilling operation. 4. Computer Assisted Part Programming using APT language 5. Exposure to component modelling and CL data generation using CAM Packages. 6. NC code generation using CAD/CAM software - post processing for standard CNC controls like FANUC, SINUMERIC, etc.

TOTAL PERIODS:	**54**

REFERENCE BOOKS:

1	S.K.Hajra Choudry - Workshop Technology, Vol.-I, &II, Media Promoters and Publishers Pvt. Ltd., 1997.
2	Mikel P.Grover, Automation, Production Systems and Computer Integrated Manufacturing, PHI Ltd., New Delhi, 2003.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH18	**Innovative Design Thinking**	**1**	**0**	**4**	**0**	**3**

PREREQUISITES:		
NIL / Course Code – Course Title / Topics		
COURSE OBJECTIVES:		
1	To Learn how to develop an innovative design model.	
2	To Identify, understand and discuss current, real-world issues.	
3	To learn the best design solution among the potential solutions with its functional decomposition probability, and combinatorics.	
4	To learn how to utilize the technical resources and to work in actual working environment.	
5	To understand how to write the technical documents and give oral presentations related to the work completed.	
	TITLE	**PERIODS**
Students are advised to create or innovate a product design matching the following objective: Instead of creating a new product and then "selling" it the public, innovative design is a process of identifying, pinpointing, and understanding the needs of the user or audience. What we need are new choices - new products that balance the needs of individuals and of society as a whole; new ideas and new strategies that tackle the global challenges of health, poverty, and education. Each student has to identify the need of a product, synthesis, analyse, design, modify and select the best design. Product Identification - Specification Development -Conceptual Design – 2D, 3D Part drawing Conduct of Functional Decomposition, Brain storming of possible solutions, process planning required for Prototypes, Refinement of Design Specification on users' feedback, Evaluation of Potential Solutions, Selection of best design. The student will make an oral presentation followed by a brief question and answer session. The innovative design (presentation and report) will be evaluated by an internal assessment committee. Presentation will take place during weekly class session. Students have to make oral presentations periodically and finally submit a technical project report.		
	TOTAL PERIODS:	**54**
COURSE OUTCOMES:		
Upon completion of this course, students will be able to:		
CO1:	develop an innovative design model	
CO2:	Identify, understand and discuss current, real-world issues.	
CO3:	Select the best design solution among the potential solutions with its functional decompositionprobability, and combinatorics.	
CO4:	utilize the technical resources and to work in actual working environment	
CO5:	write technical documents and give oral presentations related to the work completed.	

REFERENCE COURSES/BOOKS:	
1	https://www.ideo.com/
2	https://engineering.purdue.edu/EPICS
3	Yongxiang Lu, Yunhe Pan, Zhilei Xu "Innovative Design of Manufacturing" by Springer, 2020.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC14	**PLANT LAYOUT AND MATERIAL HANDLING**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To understand the concepts of plant location and plant layout
2	To identify the various factors to be considered for selection of plant locationfrom state/area to the specific site
3	To provide knowledge on materials handling equipment
4	To provide knowledge on warehouse and automated handling of materials
5	To learn about the pneumatic and hydraulic system in transportation.

THEORY

UNIT	**TITLE**	**PERIODS**
1	**PLANT LAYOUT AND MATERIAL FLOW**	**14**
Plant Location: influencing factors – rural and urban locations – evaluation of location alternatives for Single facility location problems – solving simple problems. Plant Layout: classification of production systems – principles of layout – basic types of layouts – line balancing – simple problems in line balancing using Ranking Positional Weight Method. Analysis and Design of Material Flow: Systems approach to flow cycle, process charts, flow process charts, Quantitative analysis of material flow; optimal material flow configuration. Space and Area Allocation for Production and Physical Plant Services.		
UNIT	**TITLE**	**PERIODS**
2	**ALGORITHMS FOR LAYOUT**	**14**
Computerized handling of layout algorithms; Algorithms for computerized Layout Planning, Construction and Development type of computerized Layout Planning Techniques i.e. CRAFT, ALDEP, CORELAP etc.		
UNIT	**TITLE**	**PERIODS**
3	**MATERIAL HANDLING IN PLANT**	**14**
Material Handling: functions – principles – classification of material handling equipments (only classification and no description) - factors to be considered in selection of material handling equipment. Design of system configurations conforming to various kinds of product features and layout characteristics; Design concepts of common handling and transfer equipment; Different types of conveyors, elevators, fork lifters.		
UNIT	**TITLE**	**PERIODS**
4	**WAREHOUSE HANDLING EQUIPMENTS**	**15**
Design concept of warehouse facilities commensurate with adopted kind of handling and transfer devices; Automated Handling of materials, Automated Transfer lines, AGVS, Use of Robots in Product handling, automated packaging devices.		
UNIT	**TITLE**	**PERIODS**
5	**PNEUMATIC AND HYDRAULIC SYSTEM IN TRANSPORTATION**	**15**
Application of pneumatic and hydraulic system in transportation and handling of products, Design of integrated plant layout for product handling systems.		
	TOTAL PERIODS:	**72**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Describe the concepts of plant location and plant layout

CO2:	Identify the various factors to be considered for selection of plant locationfrom state/area to the specific site and distinguish among the alternative patterns of plant layout
CO3:	Have the knowledge on materials handling equipment
CO4:	Have the knowledge on warehouse and automated handling of materials.
CO5:	Understand the pneumatic and hydraulic system in transportation.

TEXT BOOKS:	
1	S.C. Sharma, Plant Layout and Materials Handling.
2	R. B. Choudhary and G. R. N. Tagore , Plant Layout and Materials Handling
REFERENCE BOOKS:	
1	Jain, K.C. and Agarwal, L. N. – Production Planning Control & Industrial Management, Khanna Publishers, New Delhi.
2	O.P.Khanna - Industrial Engineering and Management, Dhanpat Rai Sons (P) Ltd., 1999.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC15	**RAPID PROTOTYPING**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To understand the basics of Rapid prototyping and additive manufacturing.
2	To learn how to quickly fabricate a model of a physical part or assembly using three-dimensional computer aided design (CAD) data.
3	To learn how to produce micrometer sized 3D structures
4	To understand the principle of sheet lamination process and its advantage.
5	To learn the structure of hydraulic systems and pneumatic systems in RP

THEORY

UNIT	**TITLE**	**PERIODS**
1	**INTRODUCTION ABOUT RP AND ADDITIVE MANUFACTURING**	**14**
Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Overview – Need - Development of Additive Manufacturing Technology -Principle – AM Process, Chain- Classification – Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Applications Benefits –Case studies – Reverse Engineering		
UNIT	**TITLE**	**PERIODS**
2	**CAD MODELLING AND DATA PROCESSING FOR RP**	**14**
Design tools: Data processing - CAD model preparation – Part orientation and support structure generation – Model slicing –Tool path generation- Design for Additive Manufacturing: Concepts and objectives- AM unique capabilities – DFAM for part quality improvement- Customized design and fabrication for medical applications.		
UNIT	**TITLE**	**PERIODS**
3	**PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES**	**14**
Photo polymerization: SLA-Photo curable materials – Process - Advantages and Applications. Powder Bed Fusion: SLS-Process description – powder fusion mechanism – Process Parameters – Typical Materials and Application- Electron Beam Melting.		
UNIT	**TITLE**	**PERIODS**
4	**EXTRUSION BASED AND SHEET LAMINATION PROCESSES**	**15**
Extrusion Based System: FDM-Introduction – Basic Principle – Materials – Applications and Limitations – Bio extrusion. Sheet Lamination Process: LOM- Gluing or Adhesive bonding – Thermal bonding.		
UNIT	**TITLE**	**PERIODS**
5	**PNEUMATIC AND HYDRAULIC SYSTEM IN TRANSPORTATION**	**15**
Droplet formation technologies – Continuous mode – Drop on Demand mode – Three Dimensional Printing – Advantages – Bio plotter - Beam Deposition Process: LENS- Process description – Material delivery – Process parameters – Materials – Benefits – Engineering, Medical Applications of RP.		
	TOTAL PERIODS:	**72**

COURSE OUTCOMES:
Upon completion of this course, students will be able to:

CO1:	Understand the basics of Rapid prototyping and additive manufacturing.
CO2:	Quickly fabricate a model of a physical part or assembly using three-dimensional computer aided design (CAD) data.
CO3:	how to produce micrometer sized 3D structures
CO4:	Understand the principle of sheet lamination process and its advantage.
CO5:	Understand the structure of hydraulic systems and pneumatic systems in RP
TEXT BOOKS:	
1	Chua C.K., Leong K.F., and Lim C.S., —Rapid prototyping: Principles and applications‖, Third edition, World Scientific Publishers, 2010.
2	Liou L.W. and Liou F.W., —Rapid Prototyping and Engineering applications: A tool box for prototype development‖, CRC Press, 2007.
REFERENCE BOOKS:	
1	Serope Kalpakjian and Stephen Schmid,‖Manufacturing, Engineering and Technology‖, SI 6th Edition -‖, Pearson Education, 2010.
2	Kamrani A.K. and Nasr E.A., —Rapid Prototyping: Theory and practice‖, Springer, 2006.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH06	**MAINTENANCE AND SAFETY IN INDUSTRY**	**4**	**0**	**0**	**0**	**4**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To learn the objectives and types of maintenance.
2	To learn how to predict when equipment failure might occur and to prevent its occurrence by performing maintenance.
3	To Know how to apply engineering knowledge and specialist techniques to prevent or to reduce the likelihood or frequency of failures.
4	To learn how safety improves quality and productivity in manufacturing process.
5	To Learn how to eliminate the danger of life, and to secure the safety and health of workers in industrial establishments.

THEORY

UNIT	**TITLE**	**PERIODS**
1	**TYPES OF MAINTENANCE**	**14**
Objectives of maintenance - types of maintenance – Breakdown, preventive and predictive maintenance - Repair cycle - Repair Complexity, Lubrication system – Lubricants - inspection. Maintenance of Mechanical transmission systems - align machinery – static and dynamic balancing - process plants – air conditioning – water purification – environmental control.		
UNIT	**TITLE**	**PERIODS**
2	**PREDICTIVE MAINTENANCE & CONDITION MONITORING**	**14**
Predictive Maintenance - vibration analysis data and noise as maintenance tool – wear debris analysis - Condition monitoring concepts applied to industries – diagnose faults – overhaul – testing and measurement using approved procedures - Total Productive Maintenance (TPM) - Economics of Maintenance- Computer aided maintenance – modern practice – modern manufacturing aspects.		
UNIT	**TITLE**	**PERIODS**
3	**RELIABILITY**	**14**
Reliability: Definition, concept of reliability based design, failure rate, MTTF, MTBF, failure pattern, system reliability: Series, Parallel and Mixed configurations - Availability and Maintainability concepts- applications – electro, proportional and servo hydraulic components – shutdown machinery – isolation – dismantle – inspect – NDT - assembly – fans – pumps – valves – bearings – static – dynamic seals.		
UNIT	**TITLE**	**PERIODS**
4	**SAFETY AND PRODUCTIVITY**	**15**
Safety and productivity - causes of accidents in industries – accident reporting and investigation - measuring safety performance - Safety organizations and functions - Factories act and rules - Manufacture, Storage and Import of Hazardous Chemical rules - Explosive act - Gas cylinder rules – Electricity act.		
UNIT	**TITLE**	**PERIODS**
5	**SAFETY CODES AND STANDARDS**	**15**
Safety Codes and Standards – Air Quality – indoor - outdoor – safe drinking water - General Safety considerations in Material Handling equipment's - Machine Shop machineries-pressure vessels and pressurized pipelines – IBR - welding equipment's – operation and inspection of extinguishers – prevention and spread of fire – emergency exit facilities - NFPA Standards – ISO 14000.		
	TOTAL PERIODS:	**72**

COURSE OUTCOMES:
Upon completion of this course, students will be able to:

CO1:	Know the objectives and types of maintenance.
CO2:	Predict when equipment failure might occur and to prevent its occurrence by performing maintenance.
CO3:	Apply engineering knowledge and specialist techniques to prevent or to reduce the likelihood or frequency of failures.
CO4:	Understand how safety improves quality and productivity in manufacturing process
CO5:	Know how to eliminate the danger to life, and to secure the safety and health of workers in industrial establishments.

TEXT BOOKS:	
1	Gopalakrishnan, P. and Banerji, A. K., Maintenance and Spare Parts Management, PHI Learning Pvt. Ltd., New Delhi, 2013.
2	Venkataraman .K —Maintancence Engineering and Managementǁ, PHI Learning, Pvt. Ltd. 2007.
REFERENCE BOOKS:	
1	Garg, H.P., Industrial Maintenance, S.Chand & Co Ltd., New Delhi, 1990
2	Patrick D. T. O'Connor – Practical Reliability Engineering, Wiley, 2008.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH19	**Placement Training & Skill Development Program -II**	**1**	**2**	**0**	**0**	**3**

PREREQUISITES:		
NIL / Course Code – Course Title / Topics		
COURSE OBJECTIVES:		
1	To prepare the students, think critically.	
2	To prepare the get ready for aptitude exams	
3	To Improve communication skills.	
4	To learn and Develop a synthesizing mind.	
5	To prepare about group discussions	
UNIT	**TITLE**	**PERIODS**
1	**Group discussions:**	**11**
Advantages of group discussion, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques		
UNIT	**TITLE**	**PERIODS**
2	**Reading comprehension advanced**	**11**
A course on how to approach middle level reading comprehension passages.		
UNIT	**TITLE**	**PERIODS**
3	**Problem solving**	**11**
Money-related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic, and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series;		
UNIT	**TITLE**	**PERIODS**
4	**Aptitude**	**10**
Set theory; Permutations and combinations; Probability; Statistics, Time speed and distance, work time problems.		
UNIT	**TITLE**	**PERIODS**
5	**Non-verbal reasoning, simple engineering aptitude and**	**11**
Mirror image, Water image, Paper folding, Paper cutting, Grouping of figures, Figure formation and analysis, Completion of incomplete pattern		
	TOTAL PERIODS:	**54**
COURSE OUTCOMES:		
Upon completion of this course, students will be able to:		
CO1:	Communicate convincingly and negotiate diplomatically while working in a team to arrive at a win-win situation.They would further develop their interpersonal and leadership skills.	
CO2:	Examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arriving at a consensus.	
CO3:	Identify, recall and arrive at appropriate strategies to solve questions on geometry. They will be able to investigate, interpret and select suitable methods to solve questions on arithmetic, probability, and combinatorics.	
CO4:	Relate, choose, conclude and determine the usage of right vocabulary	
REFERENCE COURSES/BOOKS:		
1	The Hard Truth about Placement Trainings, by Amazone Publication.	

2	Quantitative Aptitude by R. S. Aggarwal,S. Chand, Abijith Guha, TMH, Arun Sharma.
3	Gulati. S., (2006) “Corporate Placement Trainings”, New Delhi, India: Rupa & Co.
4	A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVC16	**PRODUCTION TECHNOLOGY LABORATORY- IV**	**0**	**0**	**8**	**0**	**4**

PREREQUISITES:

NIL / Course Code – Course Title / Topics

LABORATORY

LIST OF EXPERIMENTS

1. Study of Rapid prototype machine (Metal and Polymer 3D Printer).
2. Modelling and converting CAD models into STL files,
3. Simulation of process parameters using Catalyst software.
4. Fabrication of CAD models using Fused Deposition Modelling (FDM) machine using polymers, Converting CT/MRI scan data using MIMICS Software to fabricate the Bio-models.
5. Post processing equipment for support removal and surface finishing.

Reverse Engineering

6. Data acquired in the form of point cloud date via laser scanning using Einscan/Sense 3D system software and converting CAD models into STL files, Simulation of process parameters using Cura/ Flash Print software,
7. Fabrication of CAD models using Fused Deposition Modelling (FDM). Post processing equipment for support removal and surface finishing.

TOTAL PERIODS:	**54**

REFERENCE BOOKS:

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

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVGPGSH20	**Integral Yoga & Values-based Life and Leadership for Human Unity- III**	**1**	**0**	**4**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	

COURSE OBJECTIVES:	
1	To learn Radical Transformational Leadership tools to apply what I stand for (care about) in my everyday practice.
2	To learn systems thinking and design projects for cultural and systemic shifts and technical solutions in alignment.
3	To learn distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential

UNIT	**TITLE**	**PERIODS**
1	**Triple birth: The Threefold of Life**	**6**
Threefold potentialities of man- material man, mental man & spiritual man; Material and spiritual life in India; Collective perfection		
UNIT	**TITLE**	**PERIODS**
2	**The Systems of Yoga**	**6**
Three consenting parties & Omnipresent Trinity; Hata yoga, raja yoga, bhakti yoga, jnana yoga, karma yoga		
UNIT	**TITLE**	**PERIODS**
3	**The Synthesis of Systems**	**6**
Meaning of synthesis; Synthesis in Integral Yoga and Aim of Integral Yoga		

LABORATORY

UNIT	**TITLE**	**PERIODS**
1	**Embodying Distinctions**	**72**

(i) Intersession 2: learning about self for social transformation
(ii) Stages of Leadership
(iii) Integrity Lens
(iv) Three domains of Listening & Speaking
(v) Story of Solutions – Creating Criteria
(vi) Reviewing my BTI- CSFR and Respond & Realize; Synergistic Operational Strategies & Transformational Results Chain
(vii) Creating transformational spaces in routine activities: meetings
(viii) Interrupting disempowering ISMs
(ix) Aligning projects for Synergy based on my BTI
(x) Emotional reactions distinguished from courageous heart response
(xi) Strategic Action & Results at Scale
(xii) Fruition Time for Results
(xiii) Synergistic Partnerships for Results- using Likert Emberling Framework
(xiv) Transformational Listening and speaking: My Project, & what I will do to break disempowering ISMS- Groups of 6

TOTAL PERIODS:	**90**

COURSE OUTCOMES:
Upon completion of this course, students will be able to:

CO1:	Apply Radical Transformational Leadership tools in what I stand for (care about) in my everyday practice.
CO2:	Develop systems thinking and design projects for cultural and systemic shifts and technical solutions in alignment.
CO3:	learn distinctions that give students granularity to choose to transcend emotions and fears and work out of their full potential
REFERENCE BOOKS/ COURSES:	
1	Monica Sharma. (2017). Radical Transformational Leadership: Strategic Action for Change, North Atlantic Publishing, at Berkeley, California

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTEEC01 &02	**PROJECT PHASE- I & II**	**0**	**0**	**12**	**0**	**6**

LABORATORY

The student shall carryout a project work in the Fifth and Sixth semester. The student is given an option to carry out this project either in the institute or in an industry/Research laboratory/Higher learning Institute. The project would be carried out under the supervision of a project guide from the department. In the case of students carrying out the project outside the college an external guide from relevant organization shall be assigned in addition to the internal guide from the department.

The project work is to acquaint the student in the analysis of problems posed to him in the method of conducting a detailed literature survey and reviewing the state of art in the area of the problem. The work may be purely theoretical / analytical / completely experimental / design and fabrication. In few cases the project can also involve the above all.

At the end, a student or a group of students shall prepare and submit a project report which is expected to show clarity of thought and expressions, critical appreciation of the existing literature and analytical/experimental/design streams. The project work should be of relevant nature for the current and the future needs of the country.

The project work will be continuously monitored and assessed by the guide / project evaluation committee as a part of internal evaluation and at the end project work and the report will be examined by the panel of examiners through viva-voce

TOTAL PERIODS:	**216**

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVE01	**LEAN AND AGILE MANUFACTURING**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To learn the fundamentals of Lean Manufacturing
2	To learn what are tools used in lean manufacturing.
3	To learn how to implement the lean system in manufacturing unit.
4	To understand the fundamentals of agile manufacturing.
5	To learn the approach to manufacturing which is focused on meeting the needs of customers while maintaining high standards of quality and controlling the overall costs involved in the production of a particular product.

THEORY

UNIT	**TITLE**	**PERIODS**
1	**INTRODUCTION TO LEAN MANUFACTURING**	**10**
Introduction to Lean Manufacturing, Comparison of Mass Manufacturing and Lean Manufacturing, Lean Principles, Types of Wastes – Seven basic categories, Types of activities – Value Added, Non Value Added and Necessary but Non Value Added activities, Examples		
UNIT	**TITLE**	**PERIODS**
2	**LEAN MANUFACTURING TOOLS**	**11**
Primary Tools of Lean Manufacturing- 5S, Process Mapping and Value Stream Mapping, Work Cells, Total Productive Maintenance – Principle, Procedural steps and Advantages- Secondary Lean Tools.		
UNIT	**TITLE**	**PERIODS**
3	**LEAN RULES AND TRAINING**	**11**
Lean rules, Training and Implementation for lean systems, How to succeed with lean manufacturing, Leanness assessment – Indicators, methods and illustrative example.		
UNIT	**TITLE**	**PERIODS**
4	**AGILE MANUFACTURING**	**11**
Fundamentals of Agile Manufacturing, Agile Principles, Conceptual models of Agile Manufacturing, Product Development Strategies for agility, Developing the agile enterprise, Managing People in agile organizations.		
UNIT	**TITLE**	**PERIODS**
5	**STRATEGIC APPROACH IN AGILE MANUFACTURING**	**11**
Strategic approach to agile manufacturing, Information Technology applications in Agile Manufacturing, Assessment of agility – Activity Based Costing - Application Case studies on Lean and Agile Manufacturing.		
	TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Understand the fundamentals of Lean Manufacturing.
CO2:	Know the tools used in lean manufacturing.
CO3:	Know how to implement the lean system in manufacturing unit.
CO4:	Understand the fundamentals of agile manufacturing.

CO5:	Understand the approach to manufacturing which is focused on meeting the needs of customers while maintaining high standards of quality and controlling the overall costs involved in the production of a particular product

TEXT BOOKS:	
1	Montgomery, J.C and Levine, L. O., “The transition to agile manufacturing – Staying flexible for competitive advantage”, ASQC Quality Press, Wisconsin, 1996.
2	Gopalakrishnan “Simplified Lean Manufacture – Elements, Rules, Tools and Implementation”, PHI Learning Private Limited, New Delhi, India, 2010.
REFERENCE BOOKS:	
1	Hobbs, D.P. “Lean Manufacturing Implementation”, Narosa Publisher, 2004.
2	Devadasan, S.R., Sivakumar, V., Mohan Murugesh, R., Shalij, P, R. “Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities”, Prentice Hall India, 2012.

Course Code	Course Title	Periods per week				Credits
		L	**T**	**P**	**R**	
BVPTVE02	**ADDITIVE MANUFACTURING PROCESS**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To know the working process and technology development of Additive Manufacturing.
2	To know how to apply the principles of AM in manufacturing industry
3	To understand and analyze the concepts of AM in Production Process
4	To Know the techniques involved in AM
5	To know the application of additive manufacturing.

THEORY

UNIT	TITLE	PERIODS
1	**Development of Additive Manufacturing Technology**	**10**
Computer-Aided Design Technology, Associated Technologies, Classification of AM Processes, Metal Systems, Metal Systems, Hybrid Systems, Steps in Additive Manufacture, Maintenance of Equipment, Materials Handling Issues.		
UNIT	**TITLE**	**PERIODS**
2	**Powder Bed Fusion**	**11**
Powder Bed Fusion Processes: Introduction, Materials, Powder Fusion Mechanisms, Process Parameters and Modeling, Powder Handling, Laser, UV and IR; Process Benefits and drawbacks. Extrusion-Based Systems: Introduction, Basic Principles, Plotting and Path Control, Fused Deposition Modeling, Stereo lithography: Materials, Processes parameters, advantages and limitations.		
UNIT	**TITLE**	**PERIODS**
3	**Material and Binder Jetting**	**11**
Evolution, Materials, Material Processing Fundamentals, Material Jetting Machines, Process Benefits and drawbacks, binding materials and systems.		
UNIT	**TITLE**	**PERIODS**
4	**Design for Additive Manufacturing**	**11**
Design for Manufacturing and Assembly, AM Unique Capabilities, Core DFAM Concepts and Objectives, CAD Tools for AM.		
UNIT	**TITLE**	**PERIODS**
5	**Applications for Additive Manufacture**	**11**
Introduction, The Use of AM to Support Medical Applications, Aerospace and Automotive Applications.		
	TOTAL PERIODS:	**54**

COURSE OUTCOMES:	
Upon completion of this course, students will be able to:	
CO1:	Explain the working process and technology development of Additive Manufacturing.
CO2:	Apply the principles of AM in manufacturing industry
CO3:	Analyze the concepts of AM in Production Process
CO4:	Evaluating the techniques involved in AM
CO5:	Know the application areas of additive manufacturing.

TEXT BOOKS:	
1	Ian Gibson, David Rosen, Brent Stucker, “Additive Manufacturing Technologies”-Springer, 2ndEdition. ISBN 978-1-4939-2112-6.
2	Chee Kai Chua, Kah Fai Leong, “3D Printing and Additive Manufacturing, Principles and Applications”, 4th Ed, ISBN 978-9-8145-7140-1

REFERENCE BOOKS:	
1	Amit Bandyopadhyay, Susmita Bose " Additive Manufacturing", CRC Press 2015 ISBN 9781482223590
2	Lihni Wang, Andrew Y.C. Nee "Collabarative design and planning for digital manufacturing" Springer Series, 2009, ISBN 998-1-84882-286-3

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVE03	**NON-CONVENTIONAL MACHINING**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To learn the basics of unconventional machines.
2	To learn the fundamentals of electro chemical process.
3	To learn about the thermal and energy based machining process.
4	To understand the advanced nano finishing process.
5	To understand the recent trends in non-traditional machining process.

THEORY

UNIT	TITLE	PERIODS
1	**INTRODUCTION TO UNCONVENTIONAL MACHINES**	**10**
INTRODUCTION: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials, Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development. Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipment's, process variables, mechanics of metal removal, MRR, application and limitations.		
UNIT	**TITLE**	**PERIODS**
2	**ELECTRO CHEMICAL MACHINING PROCESS**	**11**
ELECTRO – CHEMICAL PROCESSES: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages and applications.		
UNIT	**TITLE**	**PERIODS**
3	**THERMAL AND ENERGY BASED PROCESSES**	**11**
THERMAL AND ELECTRICAL ENERGY BASED PROCESSES: Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing — Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.		
UNIT	**TITLE**	**PERIODS**
4	**ADVANCED NANO FINISHING PROCESSES**	**11**
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.		
UNIT	**TITLE**	**PERIODS**
5	**RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES**	**11**
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.		
	TOTAL PERIODS:	**54**
COURSE OUTCOMES:		

Upon completion of this course, students will be able to:	
CO1:	Know the basics of unconventional machines and its principle.
CO2:	Understand the fundamentals of electro chemical process.
CO3:	Know about the thermal and energy based machining process.
CO4:	Understand the advanced nano finishing process.
CO5:	Understand the recent trends in non-traditional machining process.

TEXT BOOKS:	
1	Hajra Choudhry, S. K. - Elements of Workshop Technology, Vol II, Media Promoters & Publishers Pvt., Ltd.
2	Jain, R. K. – A Text Book of Production Technology, Khanna Publishers, New Delhi.
REFERENCE BOOKS:	
1	Khanna, O.P. And Lal, M.- A Textbook of Production Technology, Vol II, Dhanpat Rai & Sons, New Delhi.

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVE04	**PRODUCTION PLANNING AND CONTROL**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To learn about the basics functions of production planning and control and the forecasting techniques.
2	To learn the work study, to improve productivity of men, machines and materials.
3	To determine (fix) the best and cheapest sequence of operations and to ensure that this sequence is followed in the factory.
4	To learn how to control the processes of operation planning, giving operation order and controlling operations in the manufacturing site.
5	To learn how to keep inactive, waste, surplus, scrap and obsolete items at the minimum level.

THEORY

UNIT	**TITLE**	**PERIODS**
1	**INTRODUCTION ABOUT PPC AND FORECASTING**	**10**
INTRODUCTION: Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department. FORECASTING Importance of forecasting –Types of forecasting, their uses –General principles of Forecasting –Forecasting techniques– qualitative methods- Survey of Expert opinion method , Sales force composite method, Survey of buyers intention method and quantitative methods-Simple average, moving average, smoothing coefficient, Least Square method.		
UNIT	**TITLE**	**PERIODS**
2	**WORK STUDY**	**11**
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.		
UNIT	**TITLE**	**PERIODS**
3	**ROUTING AND SCHEDULING**	**11**
Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. SCHEDULING Definition – Activities-Difference with loading, Scheduling types: Forward, Backward scheduling, Job shop scheduling methods – Arrival pattern, processing pattern, number of workers available, machine varieties available, Priority rules for job sequencing FIFO, SPT, SOT, EDD, STR, CR, LISO, Random Orders. Scheduling Techniques Gantt Charts, LOB, Johnson's job sequencing rules- n jobs on 2machines, n jobs on 3 machines, n jobs on m machines.		
UNIT	**TITLE**	**PERIODS**
4	**DISPATCHING**	**11**
DISPATCHING Centralized and Decentralized Dispatching- Activities of dispatcher – Dispatching procedure – follow-up – definition – Reason for existence of functions – types of follow up, applications of computer in production planning and control.		
UNIT	**TITLE**	**PERIODS**
5	**INVENTORY CONTROL**	**11**
Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC		

analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.		
	TOTAL PERIODS:	**54**
COURSE OUTCOMES:		
Upon completion of this course, students will be able to:		
CO1:	Apply the Manufacturing knowledge in Process Planning and will gain Confidence in controlling production	
CO2:	Know the work study, to improve productivity of men, machines and materials.	
CO3:	Determine (fix) the best and cheapest sequence of operations and to ensure that this sequence is followed in the factory.	
CO4:	Know how to control the processes of operation planning, giving operation order and controlling operations in the manufacturing site.	
CO5:	Know how to keep inactive, waste, surplus, scrap and obsolete items at the minimum level.	
TEXT BOOKS:		
1	Samuel Eilon, “Elements of Production Planning and Control”, Universal Publishing Corporation.	
2	Baffa & Rakesh Sarin , “Modern Production & Operations management”, 8th edition, John Wiley	
REFERENCE BOOKS:		
1	Jain. K.C. & Aggarwal. L.N., “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.	
2	Martin K. Starr and David W. Miller “Inventory Control Theory and Practice”, Prentice Hall.	

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
BVPTVE05	**PRODUCT DESIGN FOR MANUFACTURING**	**3**	**0**	**0**	**0**	**3**

PREREQUISITES:	
NIL / Course Code – Course Title / Topics	
Course Objective	
1	To know the basic understanding of Product design for manufacturing.
2	To learn how to cultivate, maintain and increase a company's market share by satisfying a consumer demand.
3	To learn how to develop the best concept by combining and refining the concepts of existing product to develop better ones
4	To understand the purpose of preliminary and assembly drawing.
5	To learn how to efficiently designing or engineering an object, generally during the product design stage, when it is easier and less expensive to do so, to reduce manufacturing costs

THEORY

UNIT	**TITLE**	**PERIODS**
1	**INTRODUCTION**	**10**
Introduction: Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development. Development Processes and Organizations, the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.		
UNIT	**TITLE**	**PERIODS**
2	NEW PRODUCT DEVELOPMENT	**11**
New product development process and organization- Generic product development process for Market Pull and Market Push Products, Need Identification and Analysis, Problem Formulation, establishing economic existence of need, Engineering Statement of Problem, Establishing Target Specification		
UNIT	**TITLE**	**PERIODS**
3	**CONCEPT SELECTION**	**11**
Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications. Concept Generation: The activity of concept generation, clarify the problem, search externally, search internally, explore systematically, and reflect on the results and the process. Concept Selection, Overview of methodology, concept screening, and concept scoring.		
UNIT	**TITLE**	**PERIODS**
4	**PRELIMINARY, DETAILED DESIGN AND ASSEMBLY DRAWING**	**11**
Preliminary and Detailed Design: Preliminary design, Identification of subsystems, Subsystem specifications, detailed design of subsystems, component design Assembly drawing and review: Preparation of assembly drawings, Review of product design from point of view of Manufacturing, Ergonomics and aesthetics		
UNIT	**TITLE**	**PERIODS**
5	**DESIGN FOR MANUFACTURING**	**11**
Design for Manufacturing: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors. Prototyping, Prototyping basics, principles of prototyping, technologies, planning for prototypes.		
	TOTAL PERIODS:	**54**

COURSE OUTCOMES:
Upon completion of this course, students will be able to:

CO1:	Know the basic understanding of Product design for manufacturing.
CO2:	Understand how to cultivate, maintain and increase a company's market share by satisfying a consumer demand.
CO3:	Understand how to develop the best concept by combining and refining the concepts of existing product to develop better ones
CO4:	Understand the purpose of preliminary and assembly drawing.
CO5:	Know how to efficiently designing or engineering an object, generally during the product design stage, when it is easier and less expensive to do so, to reduce manufacturing costs
TEXT BOOKS:	
1	Karl.T.Ulrich, Steven D Eppinger, Irwin, Product Design and Development, McGrawHill – 2000.
2	Timjones. Butterworth Heinmann New Product Development - - Oxford. UCI -1997
REFERENCE BOOKS:	
1	Geoffery Boothroyd, Peter Dewhurst and Winston Knight, Product Design for Manufacture and Assembly –2002.
2	A C Chitale and R C Gupta, Product Design and Manufacturing - PH1, - 3rd Edition, 2003.