GOVERNMENT POLYTECHNIC, KOLHAPUR

(An Autonomous Institute of Government of Maharashtra)

Curriculum Document

CURRICULUM: MPECS-2020

(Outcome Based Curriculum)

for

DIPLOMA IN MECHANICAL ENGINEERING

Secretary **Chairman**

Programme-wise Board of Studies (PBOS)
Mechanical Engineering Programme
Government Polytechnic, Kolhapur

INDEX

SECTION – I
CURRICULUM PHILOSOPHY AND STRUCTURE

1. CURRICULUM DEVELOPMENT: INTRODUCTION AND PROCESS OF DEVELOPMENT OF OUTCOME BASED CURRICULUM

Curriculum Design and Development:

Curriculum is an absolute instructional and effective instrument designed with a student-centered approach. It incorporates systematic method of teaching learning process. It is a sequence of planned academic activities; on completion of which the desired programme outcomes are expected to be attained in the student. The curriculum and the course contents are expected to motivate the students to acquire desired level of knowledge and skills. An emphasis and an attempt have been made in the curriculum to get a perfect blending of theoretical concepts and actual requirements of industry. Keen attention has been provided to make it more structured by incorporating the valuable suggestions of industrial experts of PBOSs and feedback by the field and academic professionals. An overview of systematic and scientific mode of implementation and evaluation has also been pondered; consequently, a practicable model of it has been achieved. It incorporates specific guidelines and assessment criteria for theory/practical/oral modes of evaluation. Specification table for each course has been provided to prepare question paper justifying meticulous coverage.

Curriculum philosophy:

The impact of globalization and rapid changes in the engineering science and technology have been a great cause of comprehensive and noticeable change in engineering fraternity, hence the institutions. Only way to incorporate such a transformation, is to modify the curriculum, preserving the consistency of engineering education. Frequent review and feedback from the experts and the freedom of autonomous status of the institution have encouraged to undertake relevant changes in the curriculum to make it versatile. Consequently, the desired competencies and skills are transformed amongst the students in pursuing their preparedness to cope up with the global changes. It aims to promote self-reliance and satisfaction of acquiring modern engineering concepts and multi capabilities within the students to make them model technicians.

"Curriculum is an educational program designed and implemented to achieve specified Programme outcomes"

Hence, in a broad sense, a curriculum incorporates the following:

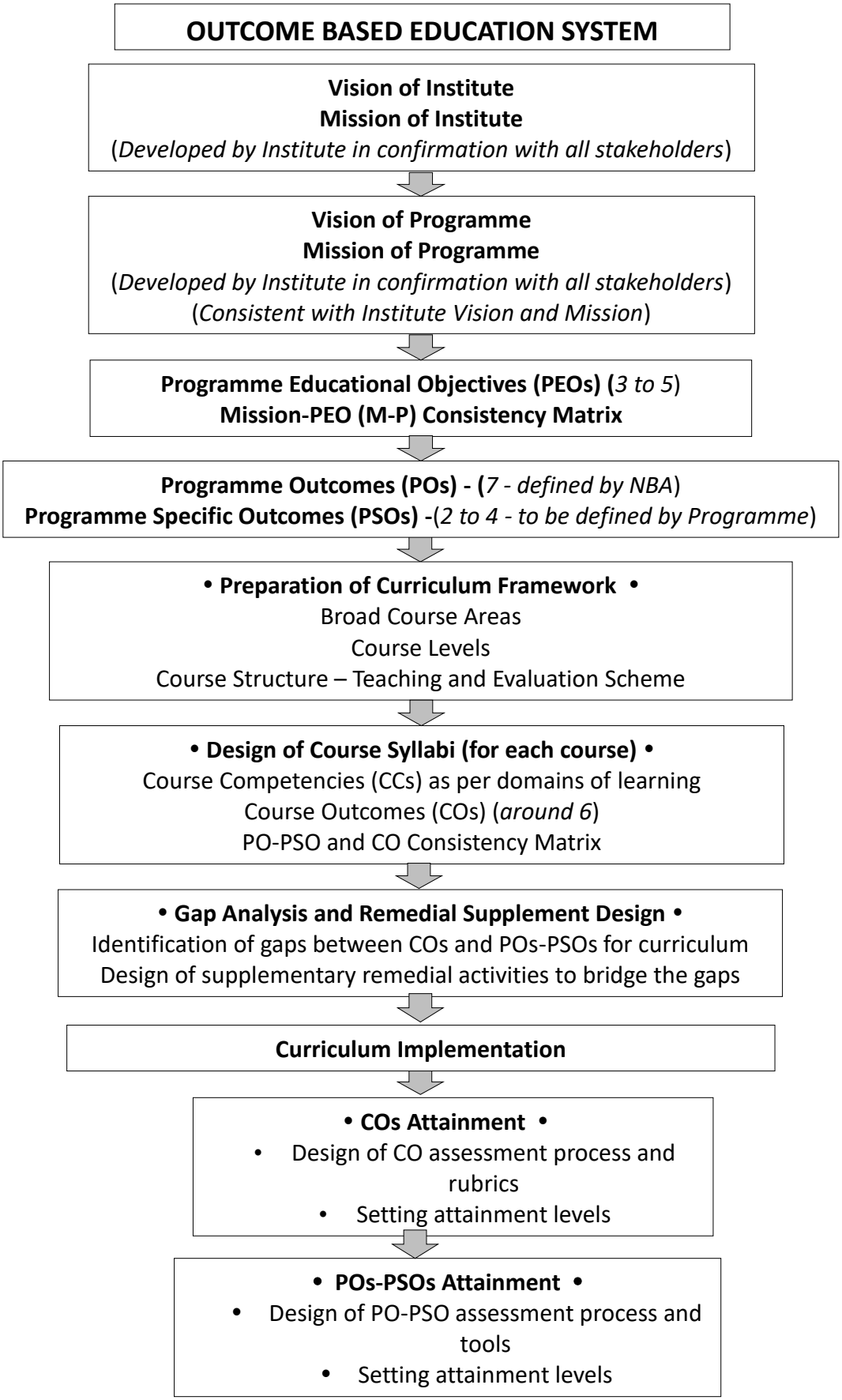
- To define the purpose of education
- To accept systematic planning methods
- To confirm implementation strategies
- To identify and to incorporate needs of industries
- To follow the policy directives
- To cope-up with social concerns
- To aim at personality development of students

- To allow future developments and challenges in emerging science and technology.

Outcome-based Curriculum

Outcome based curriculum is the curriculum based on the concepts of outcome-based education (OBE) philosophy. India is a permanent signatory of the Washington Accord - the international agreement among bodies responsible for accrediting engineering programmes with the National Board of Accreditation (NBA) as the national authority for accrediting degree and diploma programmes in engineering in India. Hence as per the accreditation criteria of the NBA, the curriculum of the Institute is expected to be outcome based.

Outcome Based Education (OBE) is an educational approach in which all the activities of an education system are based on attainment of pre-defined learning outcomes of student. The approach is to be included in the following three aspects of education system: i) Curriculum Design, ii) Curriculum Implementation, iii) Students' Evaluation. The flow diagram shown below summarizes the elements of Outcome-based Education System. The glossary of terms used in academic autonomy and OBE are provided for reference.


OUTCOME BASED EDUCATION SYSTEM
Vision of Institute
Mission of Institute
(Developed by Institute in confirmation with all stakeholders)
Vision of Programme
Mission of Programme
(Developed by Institute in confirmation with all stakeholders)
(Consistent with Institute Vision and Mission)
Programme Educational Objectives (PEOs) (3 to 5)
Mission-PEO (M-P) Consistency Matrix
Programme Outcomes (POs) - (7 - defined by NBA)
Programme Specific Outcomes (PSOs) -(2 to 4 - to be defined by Programme)
• Preparation of Curriculum Framework •
Broad Course Areas
Course Levels
Course Structure – Teaching and Evaluation Scheme
• Design of Course Syllabi (for each course) •
Course Competencies (CCs) as per domains of learning
Course Outcomes (COs) (around 6)
PO-PSO and CO Consistency Matrix
• Gap Analysis and Remedial Supplement Design •
Identification of gaps between COs and POs-PSOs for curriculum
Design of supplementary remedial activities to bridge the gaps
Curriculum Implementation
• COs Attainment •
• Design of CO assessment process and rubrics
• Setting attainment levels
• POs-PSOs Attainment •
• Design of PO-PSO assessment process and tools
• Setting attainment levels

Glossary of terms related to Outcome Based Education

Outcome-Based Education (OBE) - It is an educational approach in which all the activities of an education system are based on attainment of pre-defined learning outcomes of student.

The approach is to be included in the following three aspects of education system:
i) Curriculum Design, ii) Curriculum Implementation, iii) Students' Evaluation

Washington Accord and NBA–It is an International Agreement among bodies responsible for accrediting undergraduate engineering degree programmes. Established in 1989, the signatory countries as of 2014 are Australia, Canada, Taiwan, Hong Kong, India, Ireland, Japan, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Sri Lanka, Turkey, the United Kingdom and the United States. National Board of Accreditation (NBA), India has become the permanent signatory member of the Washington Accord on 13thJune 2014.

The membership of Washington Accord is an international recognition of the quality of undergraduate engineering education offered by the member country and is an avenue to bring it into the world class category. It encourages and facilitates the mobility of engineering graduates and professionals at international level.

NBA accreditation is a quality assurance scheme for higher technical education in India.

The Washington Accord covers engineering degrees and diploma under outcome-based education approach.

Vision of Institute - It is a statement that defines concisely the aspirations to be achieved in the near future by the Institute

Mission of Institute - It is a set of statements that defines the broad steps to be executed to achieve the vision of the Institute

Vision of Programme - It is the vision statement for a particular educational programme (like Civil Engineering Programme, Mechanical Engineering Programme, etc.). Programme Vision should be consistent with the Institute vision

Mission of Programme - It is the set of statements that define the broad steps to be executed to achieve the vision of the educational programme

Programme Educational Objectives (PEOs) - It is a set of 3 to 5 statements defining the objectives to be attained in order to execute the mission

Programme Outcomes (POs) – It is a set of ten generic outcomes, stated by NBA, expected from any engineering diploma-holder in India

Programme-specific Outcomes (PSOs) – It is a set of 2 to 4 outcomes to be defined by the programme under consideration in addition to the Pos

Course Outcomes (COs) – It a set of about 6 outcomes, expected to be attained by student on learning a course. Course Outcomes shall be defined in curriculum for each course. Course outcomes are worded using action verbs like solve, explain, calculate, compare, distinguish, describe, draw, etc.

Mission-PEO Consistency Matrix – It is a matrix showing degree of consistency of PEOs with mission

PO-CO Consistency Matrix – It is a matrix showing degree of consistency of COs with POs and PSOs

Competency – It is the set of specific abilities, categorized as cognitive, psychomotor and affective domains of learning, from which course outcomes statements are derived

Cognitive domain –It is the set of abilities related to thinking

Bloom's Revised Taxonomy of Cognitive Domain: It is a six-level cumulative hierarchy of cognitive abilities in the order of increasing complexity as follows:

Remembering > *Understanding* > *Applying* > *Analyzing* > *Evaluating* > *Creating*

Psychomotor Domain: It is the set of abilities related to physical and psychological skills

Taxonomy of Psychomotor Domain: It is a six-level cumulative hierarchy of cognitive abilities in the order of increasing complexity as follows:

Perception > *Set*> *Guided response*>*Mechanism* > *Adaptation* >*Origination*

Affective Domain: It is the set of abilities related to attitudinal development

Taxonomy of Affective Domain: It is a five-level cumulative hierarchy of affective abilities in the order of increasing complexity as follows:

Receiving > *Responding* > *Valuing* > *Organizing* >*Characterizing*

Educational Technology: It is the systematic study of theoretical foundations and material tools to facilitate learning

Glossary of terms used in Academic Autonomy and MPECS

Academic Autonomy – It is the freedom and responsibility offered to the Institute by the Government to attain high quality standards in the following three dimensions:
i) Design of own curricula ii) Conduct of own examinations iii) Award of own diploma

Multi-point Entry and Credit System (MPECS) – It is a system of education in which student can be admitted at different entry levels of qualification and he is offered *credits* along with marks on passing in a course

Credits – It is the number of weekly instructional hours provided for a course in the curriculum

Programme – It is the particular branch of Engineering in which Diploma is awarded. e.g. Civil Engineering Programme, Mechanical Engineering Programme, etc.

Curriculum – It is a document providing plan of the complete academic activity to be conducted by student for award of Diploma in a Programme in tune with the vision of the Institute

Course – It is a particular subject defining study and evaluation unit of the curriculum. e.g., Applied Mechanics, Engineering Drawing-1, etc.

Syllabus – It is the complete academic information regarding a particular course in a curriculum

Course Registration (CR) -It is the procedure to be carried out by every student at the beginning of every semester in which he/she has to declare the courses he/she is going to study in that semester as per academic time table of the Institute. The registration is to be done as per *Rules of Registration* of the Institute.

Examination Registration (ER) -It is the procedure to be carried out by every student at the beginning of every semester in which he/she has to declare the courses in which he/she is going appear for examination in that semester as per examination time table of the Institute. The registration is to be done as per *Rules of Registration* of the Institute.

Curriculum MPECS-2020 - It is the Curriculum of the Institute revised in the year 2020. It is applicable to the students admitted since 2020

Programme Department – It is the department of the Institute offering Diploma in a particular Programme. e.g., Civil Engineering Department, Mechanical Engineering Department, etc.

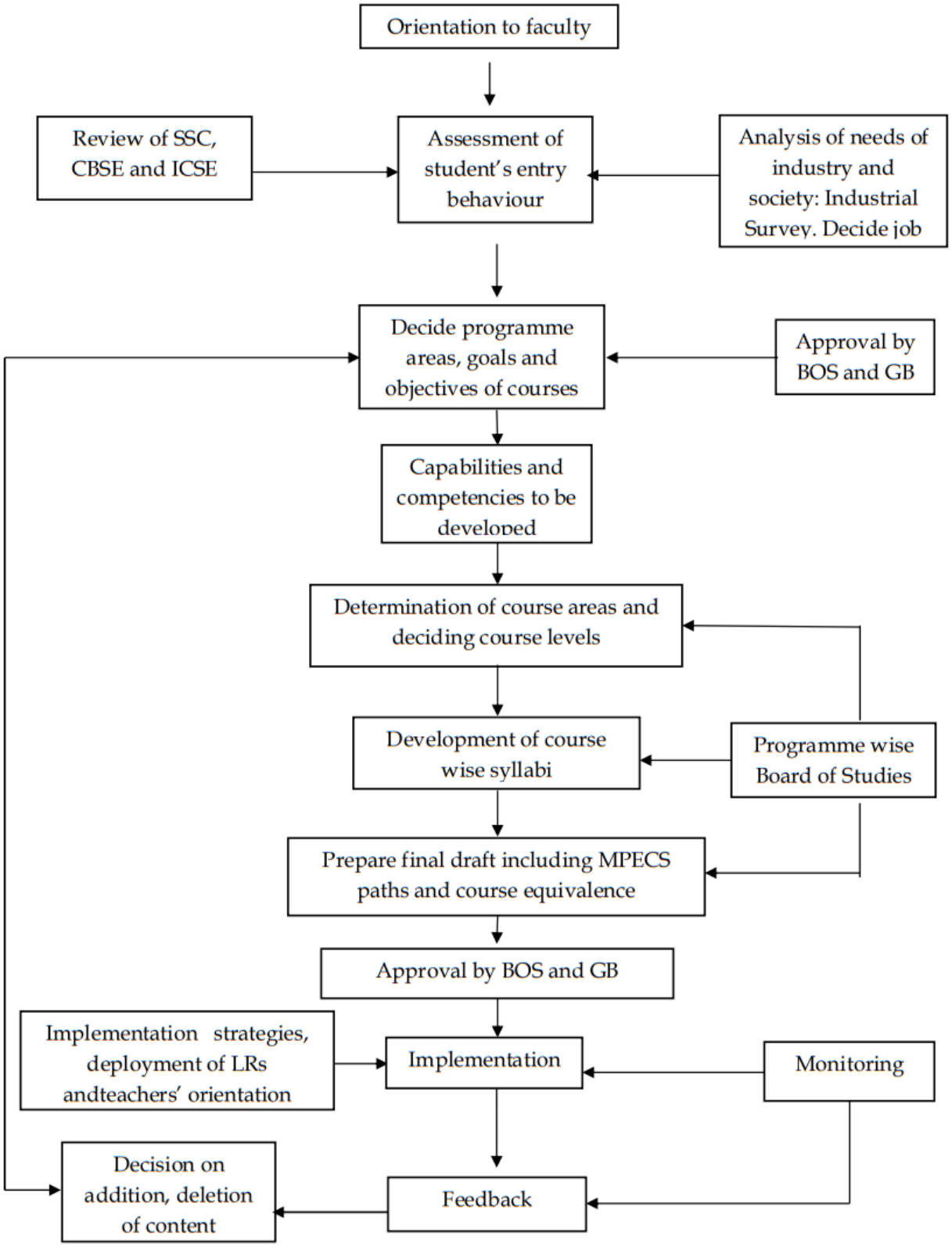
Programme Dean – He/she is the Head of Department of a Programme Department

Allied Department – It is department that does not award diploma and contributes to curriculum implementation of many Programmes. e.g. Applied Mechanics Department, Workshop Department, Science Department, English Department, Mathematics Department, etc.

Academic Autonomy and MPECS at Government Polytechnic, Kolhapur –

- Year of award of academic autonomy: 1992
  Government Polytechnic, Kolhapur is the first Government Polytechnic in Maharashtra to have been awarded academic autonomy
- Year of award of MPECS and Flexibility: 1994
- Bodies and Cells under Academic Autonomy:
  i) Governing Body
  ii) Board of Studies
  iii) Programme-wise Boards of Studies
- Examination Committee Curriculum Revisions under Autonomy: 1992, MPECS-2001, MPECS-2006, MPECS-2010, MPECS-2013, MPECS-2016, MPECS 2020
- Award of Diploma in *Convocation Ceremony* every year

Curriculum Development Model:



2. VISION, MISSION, PROGRAMME EDUCATIONAL OBJECTIVES (PEOs), PROGRAMME OUTCOMES (POs) AND PROGRAMME SPECIFIC OUTCOMES (PSOs)

Vision of Institute:

Institute of high recognition developing competent technicians for quality services or entrepreneurship to cater the needs of industry and society.

Mission of Institute:

- To educate and train in multi-disciplinary multi-level programmes to develop technicians and skilled manpower having global competency
- To ensure employability, encourage entrepreneurship, promote lifelong learning
- To inculcate in the students the qualities of a good citizen at individual, social and professional level
- To provide quality management system with focus on effective student-centric education
- To utilize faculty expertise and Institute infrastructure to render quality consultancy services

Vision of Mechanical Engineering Programme:

Internationally recognized programme for development of mechanical engineering technicians providing platform for entrepreneurship and incubation for industry of the country.

Mission of Mechanical Engineering Programme:

- To educate and train students for employment or entrepreneurship or higher education in mechanical engineering
- To provide student centric learning system having focus on development of global professional competency
- To inculcate elements of holistic personality, responsible citizenship and social concern

Programme Educational Objectives (PEOs):

Within three years of Diploma, students are able to –

1. Be employed as a practicing engineer in the fields of manufacturing and service sectors.
2. Assume positions of leadership and responsibility within an organization.
3. Progress through higher education and certificate programs in Engineering and other professionally related fields.
4. Startup own service or manufacturing enterprise.
5. Apply a set of moral principles to all interactions with stakeholders.

Programme Outcomes (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

Programme Specific Outcomes (PSOs)

1. Learner will be able to work in manufacturing and service sectors as a production supervisor, quality inspector, design and drafting assistant, maintenance engineer, planning assistant.
2. Start entrepreneurial activity in the Mechanical Engineering field.

Job profiles and related Competencies for the diploma holder

The curriculum for mechanical engineering Programme is primarily developed with the focus on small, medium size mechanical engineering enterprises & large size organization in & around the region. The enterprises will be production, manufacturing, sales, repairs & maintenance, services to the community etc. The enterprises may be private sector, public sector govt. sector where diploma holders in mechanical engineering may work as supervisor, technician, junior engineer, assistant manager or he may become an entrepreneur.

The main aims of mechanical engineering programme are to induce the following qualities in the diploma holders.

Social Skills

1) To be a good citizen.
2) Answer question and proposals in appropriate manner.
3) Prepare impact instructions to pears/subordinates.
4) Write letter, report & proposals in appropriate manner.
5) Develop an attitude to work in team for achieving goals.
6) Develop listening skill and respect for other operations.
7) To learn how to use library literature and gathering of information.
8) Develop skill to work independently for problem solving.
9) To develop creative thinking.
10) Awareness of Government Rules.

Technical Skills

1) Apply problem solving models to arrive at proper solutions of technical problems.
2) Develop supervisory and managerial skills.
3) Use of different types of measuring instrument.
4) Use of statistical quality control techniques used in industries.
5) Apply decision making techniques.
6) Detect faults and repairs of mechanical units.
7) Design machine parts by applying standard design procedure.
8) Selection of different types of materials.
9) Calculation of standard time.
10) Conduct time study and method study by using standard methods.
11) Preparing process sheets & flow charts.
12) Selection of different types of cutting tools.
13) Selection of machining parameters.
14) Selection of different types of lubricants & coolants.
15) Selection of various machines tools.
16) Design of simple jigs & fixtures.
17) Draw, read, interpret working drawings.
18) Use of PERT & CPM techniques.
19) Prepare simple program for CNC machine.
20) Use of various safety devices.
21) Estimating product cost.
22) Preparation of Project report.
23) Market Survey.
24) Selection of Engines for different application.
25) Load calculations for refrigeration and air conditioning systems.
26) Selection of various parts and equipments used for different refrigeration and air conditioning systems.
27) Detect and rectify the faults of refrigeration and air conditioning.

28) Use of Garage tools and maintenance.
29) Calculate performance characteristics of I.C. Engines and Hydraulic machineries.
30) Use of drafting software.
31) Prepare simple computer program and execute.
32) Elementary exposure to ISO.

Aims of Mechanical Engineering Programme are prepared in order to have various technical skills and abilities to be acquired by the diploma holders in mechanical engineering, so that he can fulfill industrial requirements precisely.

Considering these aims, the contents of Mechanical Engineering Program is divided in five levels. In First level, students will be exposed to introductory aspects of foundation courses, like Mathematics, Engineering Drawing, Physics, Chemistry, Workshop Practice etc. From this level, students will acquire basic knowledge of above said courses which is required for higher levels.

Second level is Life Skills and Professional Skills courses which cover Communication Skills in English, Introduction to IT System, Environmental Science, Essence of Indian Traditional Knowledge and Indian Constitution which impart students to acquire social and professional skill.

Third level is of basic technology courses which are prepared to induce necessary skills, abilities and knowledge of different mechanical engineering courses like Thermal Engineering, Machine Drawing, Manufacturing Processes, Machine Tools, Engineering Metallurgy, Metrology, Theory of Machine and Computer Aided Drafting etc.

Fourth level is applied technology courses. Content of this level is structured to impart skills, abilities and knowledge of advanced mechanical engineering courses like Power Engineering, Machine Design, Fluid Mechanics and Machinery, Mechanical Measurements, Advanced Machining Processes and Solid Modeling. Students are also exposed to specialized fields like maintenance, instrumentation, 3D Modeling and CNC machines.

Fifth level is Management and diversified courses. This level is designed to develop managerial skills, abilities and knowledge of Industrial Engineering, Industrial Organization and Management and Entrepreneurship and Startup. It also includes diversified courses like Industrial Hydraulics and Pneumatics, Tool Engineering, Welding Technology, Foundry Technology, Automobile Engineering and Refrigeration and Air Conditioning.

Contents of all five level courses are structured in sequential and logical manner so as to cover cognitive, psychomotor, and affective domains of learning.

3. OVERVIEW AND SALIENT FEATURES OF CURRICULUM: MPECS-2020

3.1 Overview of Curriculum MPECS-2020

Total No. of Credits		180
No. of courses offered	Total	43
	Theory	28
Max. no. courses in a semester		08
Total Maximum Marks		4500
Courses in Level IV and V	No.	16
	Credits	69
	Marks	1700
Courses in Level I	No.	10
	Credits	39
	Marks	975
Courses in Level II	No.	05
	Credits	09
	Marks	150
Courses in Level III	No.	12
	Credits	63
	Marks	1675
Courses in Level IV	No.	09
	Credits	42
	Marks	1000
Courses in Level V	No.	07
	Credits	27
	Marks	700
%Ratio of Th:Pr	Credit-wise	52: 48
	Marks-wise	61: 39
No. of Allied Courses		01
Optional Courses	No. of courses	03
	Options/course	03
No. of Practical Exams	External	08
	Internal	14
No. of Oral Exams	External	09
	Internal	04

Diploma shall be awarded on the basis of marks obtained in Level IV and Level V courses

3.2 Salient Features of Curriculum MPECS-2020

Addition and deletion of Courses with respect to MPECS-2016:

1) In the first semester the course titled "Generic skill" is removed.
2) The course "communication skill" is shifted to first semester from second semester and renamed as "Communication skills in English". The content of this course is enhanced to meet industry-specific communication skills.
3) The new course "Sport and Yoga" is introduced in the first semester. This will help student to become health conscious and practice sport and yoga. This will certainly help student to have better health. This course doesn't have end examination.
4) In first semester a course titled "Environmental Science" is introduced. This will enrich awareness in students towards protection and importance of pollution free environment. This is non credit and non-examination type course.
5) The new course "Introduction to IT system" is introduced in second semester. This will help student to become familiar with use of IT system in industries and in daily practice.
6) The course "Electrical Technology" from third semester and the course "Applied Electronics" from fourth semester is merged into a single course titled "Basic Electrical and Electronics Engineering". Following content is added as per the recommendation from industrial experts.
   - Basics of Earthing and electrical safety.
7) In third semester a course "Computer Programming" is replaced by a new course titled "Computer aided drafting". This course is enriched with the new drafting softwares mostly used in Industries.
8) A new course titled "Essence of Indian traditional Knowledge" is added to third semester. This course explores Indian culture and tradition. This is non credit and non examination type course.
9) The course titled "Professional Practices" is removed from the fourth semester
10) In fourth semester a course "Computer applications" is replaced by a course "Solid modeling". This course explores the new software's related to 3D modeling which are used in Industries.
11) In the fourth semester the course Elective –I group (Higher Mathematics/Non-Conventional Energy sources/Pollution Control) is removed.
12) Industrial experts suggested that knowledge of Mechatronics is essential for Diploma mechanical engineering student; therefore, the course "Mechatronics and Robotics" is included in fifth semester as a compulsory course.
13) The level of the course "Engineering Metrology" is shifted from level 4 to level 3 and it is included in the fourth semester instead of the sixth semester.
14) In the fifth semester elective Course "Mechanical Measurements and Mechatronics" bifurcated in two courses titled as "Mechanical Engineering Measurements" and "Mechatronics and Robotics". Both these courses are compulsory. "Mechanical

Engineering Measurements" is included in fourth semester and "Mechatronics and Robotics" is included in fifth semester.

15) In fifth semester new elective Course "Emerging Trends in Mechanical Engineering" is included. In this course latest technology trends in the field of manufacturing, automobiles and surface technology are included.
16) The course "Quality Management" is shifted from sixth semester to fifth semester and it is offered as elective course.
17) The elective course "Quality Systems" removed from fifth semester.
18) In fifth semester "Internship –I" is added. In "Internship –I" students will undergo industrial training for the duration of 4 weeks after fourth semester during summer vacation.
19) The level 5 course "Industrial Engineering" is shifted from fifth semester to sixth semester.
20) In sixth semester a new course "Entrepreneurship and startup" is added in place of "Entrepreneurship Development".
21) In sixth semester a new course "Indian Constitution" is added. This is non-credit and non-examination type course.
22) In sixth semester "Internship – II" is added. In "Internship – II" students will undergo industrial training for the duration of 3 weeks after fifth semester during winter vacation.

Changes in Implementation Strategy and Treatment with respect to MPECS-2016: In MPECS 2016 curriculum there were 12 elective courses equally arranged in 4 groups (3 in each group) out of that 3 groups are continued in MPECS2020 and the courses "Mechanical Engineering Measurements" and "Mechatronics and Robotics" are made compulsory.

4. TEACHING AND EXAMINATION SCHEME (LEVEL-WISE)

Sr. No.	Name of Course	Course Code	Course Abbre-viation	Level	Pre-requisite Course	Teaching Scheme (hours per week)			Examination Scheme (marks)			
						TH	PR. / DRG. / Tutorial	Credits	TH	TS	PR	OR
	Level 1: Foundation Courses											
1	Engineering Physics	CCG101	GPHA	1	--	3	2	5	80	20	50	
2	Engineering Chemistry	CCG103	GCHA	1	-	3	2	5	80	20	50	
3	Basic Mathematics	CCG105	GBMT	1	-	3	1	4	80	20		
4	Engineering Mathematics	CCG106	GEMT	1	CCG105	3	1	4	80	20		
5	Engineering Drawing - 1	CCG107	GEDA	1	-	3	2	5	80	20	25	
6	Engineering Drawing - 2	CCG108	GEDB	1	CCG107	3	2	5	80	20	25	
7	Applied Mechanics	CCG110	GAPM	1	--	3	2	5	80	20	25	
8	Workshop Practice-1	CCG112	GWSB	1	-	-	2	2	-	-	50	
9	Workshop Practices 2	CCG116	GWSF	1	CCG112	-	2	2	-	-	50	
10	Sports and Yoga	CCG117	GSPY	1	-	-	2	2				
	Level 2: Life skill and Professional skill courses											
11	Introduction to IT System	CCG201	GITS	2	-	2	2	4	-	-	50	
12	Communication Skills in English	CCG203	GCMS	2	-	3	2	5	40	10	50	
13	Environmental Science	CCG204	GEVS	2		2		0				
14	Essence of Indian Traditional Knowledge	CCG205	GITK	2		2		0				
15	Indian Constitution	CCG206	GINC	2		2		0				
	Level 3: Basic Technology Courses											
16	Applied Mathematics	MEG301	GAMT	3	CCG305, CCG106	3	1	4	80	20		
17	Thermal Engineering	MEG302	GTEG	3	-	3	2	5	80	20		50E
18	Machine Drawing	MEG303	GMDR	3	CCG107	3	2	5	80	20		50E
19	Manufacturing Processes	MEG304	GMPR	3	-	3	4	7	80	20	50E	
20	Strength of Materials	MEG305	GSOM	3	CCG110	3	2	5	80	20		50E
21	Machine Tools	MEG306	GMTL	3		3	4	7	80	20	75E	
22	Theory of Machines	MEG308	GTOM	3	-	3	2	5	80	20		50E
23	Basic Electrical and Electronics Engineering	MEG309	GBEE	3	-	4	2	6	80	20	50I	
24	Engineering Metallurgy and Materials	MEG310	GEMM	3	-	3	2	5	80	20	50I	
25	Engineering Metrology	MEG314	GEME	3	-	3	2	5	80	20	50I	
26	Computer Aided Drafting	MEG315	GCAD	3	-	0	4	4	-	-	50E	
27	Mechanical Engineering Measurements	MEG316	GMEM	3	-	3	2	5	80	20	50I	
	Level 4: Applied Technology Courses											
28	Power Engineering	MEG401	GPEG	4	MEG302	4	2	6	80	20		50E
29	Machine Design	MEG402	GMDN	4	MEG305	4	2	6	80	20		50E
30	Advanced Machining Processes	MEG403	GAMP	4		2	4	6	80	20		50I
31	Project- 1	MEG404	GPRT	4	-	-	2	2				50I
32	Project- 2	MEG405	GPRO	4	MEG404	-	4	4				100E
33	Fluid Mechanics & Machinery	MEG406	GFMM	4	-	4	2	6	80	20	50E	
34	Solid Modeling	MEG414	GSMD	4	-	1	2	3			50E	
35	Mechatronics and Robotics	MEG415	GMTR	4	-	2	2	4			50I	
36	Elective-1< MEG416 TO MEG418>(Any One)	-	-	4	-	3	2	5	80	20		50I
	Level 5: Management and Diversified Technology Courses											
37	Entrepreneurship Development	CCG501	GESU	5	-	2	2	4				50I
38	Internship 1 (4 weeks -After FOURTH Semester During Summer Vacation)	CCG502	GINO	5		-	3	3			50E	
39	Internship 2 (3 weeks -After FIFTH Semester During Winter Vacation)	CCG503	GINT	5		-	2	2			50E	
40	Industrial Org. And Management	MEG501	GIOM	5	-	3	-	3	80	20		
41	Industrial Engineering	MEG503	GIEG	5	-	3	2	5	80	20		50I
42	Elective-2< MEG504 TO MEG506> (Any One)	-	-	5	-	3	2	5	80	20		50E
43	Elective-3< MEG507 TO MEG509> (Any One)	-	-	5	-	3	2	5	80	20	50E	
		TOTAL				**94**	**86**	**180**	**2200**	**550**	**1050**	**700**

OPTIONAL COURSES FOR ELECTIVES

Sr No	Name of Course	Course Code	Course Abbreviation	Level	Pre-requisite Course	Teaching Scheme (hours per week)			Examination Scheme (marks)			
						TH	PR./ DRG./ Tutorial	Credits	TH	TS	PR	OR
	Elective-1 (Any One)											
36 A	Marketing Management	MEG416	GMGM	4	-	3	2	5	80	20		50I
36 B	Emerging Trends in Mechanical Engineering	MEG417	GETM	4	-	3	2	5	80	20		50I
36 C	Total Quality Management	MEG418	GTQM	4	-	3	2	5	80	20		50I
	Elective-2 (Any One)											
42 A	Foundry Technology	MEG504	GFTL	5	-	3	2	5	80	20		50E
42 B	Refrigeration & air conditioning	MEG505	GRAC	5	-	3	2	5	80	20		50E
42 C	Automobile Engineering	MEG506	GAEG	5	-	3	2	5	80	20		50E
	Elective-3 (Any One)											
43 A	Industrial Hydraulics & Pneumatics	MEG507	GIHP	5	-	3	2	5	80	20	50E	
43 B	Tool Engineering	MEG508	GTLG	5	-	3	2	5	80	20	50E	
43 C	Welding Technology	MEG509	GWLT	5	-	3	2	5	80	20	50E	

5. PATH-WISE COURSE STRUCTURES (MPECS 2020)

Path-1: Students admitted to First Year - X std. and X std. Tech pass outs

Sr. No.	Name of Course	Course Code	Course Abbreviation	Level	Pre-requisite Course	Teaching Scheme (hours per week)			Examination Scheme (marks)			
						TH	PR. / DRG / Tut	Credits	TH	TS	PR	OR
	Semester 1											
1	Engineering Chemistry	CCG103	GCHA	1	-	3	2	5	80	20	50	
2	Basic Mathematics	CCG105	GBMT	1	-	3	1	4	80	20		
3	Engineering Drawing - 1	CCG107	GEDA	1	-	3	2	5	80	20	25	
4	Communication Skills in English	CCG203	GCMS	2	-	3	2	5	40	10	50	
5	Workshop Practice-1	CCG112	GWSB	1	-		2	2			50	
6	Sports and Yoga	CCG117	GSPY	1	-		2	2				
7	Environmental Science	CCG204	GEVS	2		2		0				
	Semester 2											
8	Engineering Physics	CCG101	GPHA	1	--	3	2	5	80	20	50	
9	Engineering Mathematics	CCG106	GEMT	1	CCG105	3	1	4	80	20		
10	Engineering Drawing - 2	CCG108	GEDB	1	CCG107	3	2	5	80	20	25	
11	Applied Mechanics	CCG110	GAPM	1	--	3	2	5	80	20	25	
12	Workshop Practices - 2	CCG116	GWSF	1	CCG112	0	2	2			50	
13	Introduction to IT System	CCG201	GITS	2	-	2	2	4			50	
	Semester 3											
14	Applied Mathematics	MEG301	GAMT	3	CCG105, CCG106	3	1	4	80	20		
15	Machine Drawing	MEG303	GMDR	3	CCG107	3	2	5	80	20		50E
16	Manufacturing Processes	MEG304	GMPR	3	-	3	4	7	80	20	50E	
17	Strength of Materials	MEG305	GSOM	3	CCG110	3	2	5	80	20		50E
18	Basic Electrical and Electronics Engineering	MEG309	GBEE	3	-	4	2	6	80	20	50I	
19	Computer Aided Drafting	MEG315	GCAD	3	-	0	4	4			50E	
20	Essence of Indian Traditional Knowledge	CCG205	GITK	2		2		0				
	Semester 4											
21	Thermal Engineering	MEG302	GTEG	3	-	3	2	5	80	20		50E
22	Machine Tools	MEG306	GMTL	3	-	3	4	7	80	20	75E	
23	Theory of Machines	MEG308	GTOM	3	-	3	2	5	80	20		50E
24	Engineering Metallurgy and Materials	MEG310	GEMM	3	-	3	2	5	80	20	50I	
25	Engineering Metrology	MEG314	GEME	3	-	3	2	5	80	20	50I	
26	Mechanical Engineering Measurements	MEG316	GMEM	3	-	3	2	5	80	20	50I	
27	Solid Modeling	MEG414	GSMD	4	-	1	2	3			50E	
	Semester 5											
28	Power Engineering	MEG401	GPEG	4	MEG302	4	2	6	80	20		50E
29	Machine Design	MEG402	GMDN	4	MEG305	4	2	6	80	20		50E
30	Advanced Machining Processes	MEG403	GAMP	4		2	4	6	80	20		50I
31	Fluid Mechanics & Machinery	MEG406	GFMM	4	-	4	2	6	80	20	50E	
32	Elective-1< MEG416 TO MEG418> (Any One)	-	-	4	-	3	2	5	80	20		50I
33	Mechatronics and Robotics	MEG415	GMTR	4	-	2	2	4			50I	
34	Project- 1	MEG404	GPRT	4	-		2	2				50I
35	Internship 1 (4 weeks -After FOURTH Semester During Summer Vacation)	CCG502	GINO	5			3	3			50E	
	Semester 6											
36	Industrial Org. And Management	MEG501	GIOM	5	-	3		3	80	20		
37	Industrial Engineering	MEG503	GIEG	5	-	3	2	5	80	20		50I
38	Elective-2< MEG504 TO MEG506> (Any One)	-	-	5	-	3	2	5	80	20		50E
39	Elective-3< MEG507 TO MEG509> (Any One)	-	-	5	-	3	2	5	80	20	50E	
40	Project- 2	MEG405	GPRO	4	MEG404		4	4				100E
41	Entrepreneurship Development	CCG501	GESU	5	-	2	2	4				50I
42	Internship 2 (3 weeks -After FIFTH Semester During Winter Vacation)	CCG503	GINT	5			2	2			50E	
43	Indian Constitution	CCG206	GINC	2		2		0				
						94	**86**	**180**	**2200**	**550**	**1050**	**700**

Path-2: Students admitted directly to Second Year with XII Science (PCM/PCMB)

Sr. No.	Name of Course	Course Code	Course Abbreviation	Level	Pre-requisite Course	Teaching Scheme (hours per week)			Examination Scheme (marks)			
						TH	PR. / DRG / Tut	Credits	TH	TS	PR	OR
	Semester 3											
1	Applied Mathematics	MEG301	GAMT	3	CCG105, CCG106	3	1	4	80	20		
2	Machine Drawing	MEG303	GMDR	3	CCG107	3	2	5	80	20		50E
3	Manufacturing Processes	MEG304	GMPR	3	-	3	4	7	80	20	50E	
4	Strength of Materials	MEG305	GSOM	3	CCG110	3	2	5	80	20		50E
5	Basic Electrical and Electronics Engineering	MEG309	GBEE	3	-	4	2	6	80	20	50I	
6	Computer Aided Drafting	MEG315	GCAD	3	-	0	4	4			50E	
7	Essence of Indian Traditional Knowledge	CCG205	GITK	2		2		0				
	Semester 4											
8	Thermal Engineering	MEG302	GTEG	3	-	3	2	5	80	20		50E
9	Machine Tools	MEG306	GMTL	3	-	3	4	7	80	20	75E	
10	Theory of Machines	MEG308	GTOM	3	-	3	2	5	80	20		50E
11	Engineering Metallurgy and Materials	MEG310	GEMM	3	-	3	2	5	80	20	50I	
12	Engineering Metrology	MEG314	GEME	3	-	3	2	5	80	20	50I	
13	Mechanical Engineering Measurements	MEG316	GMEM	3	-	3	2	5	80	20	50I	
14	Solid Modeling	MEG414	GSMD	4	-	1	2	3			50E	
	Semester 5											
15	Power Engineering	MEG401	GPEG	4	MEG302	4	2	6	80	20		50E
16	Machine Design	MEG402	GMDN	4	MEG305	4	2	6	80	20		50E
17	Advanced Machining Processes	MEG403	GAMP	4		2	4	6	80	20		50I
18	Fluid Mechanics & Machinery	MEG406	GFMM	4	-	4	2	6	80	20	50E	
19	Elective-1< MEG416 TO MEG418> (Any One)	-	-	4	-	3	2	5	80	20		50I
20	Mechatronics and Robotics	MEG415	GMTR	4	-	2	2	4			50I	
21	Project- 1	MEG404	GPRT	4	-		2	2				50I
22	Internship 1 (4 weeks -After FOURTH Semester During Summer Vacation)	CCG502	GINO	5			3	3			50E	
	Semester 6											
23	Industrial Org. And Management	MEG501	GIOM	5	-	3		3	80	20		
24	Industrial Engineering	MEG503	GIEG	5	-	3	2	5	80	20		50I
25	Elective-2< MEG504 TO MEG506> (Any One)	-	-	5	-	3	2	5	80	20		50E
26	Elective-3< MEG507 TO MEG509> (Any One)	-	-	5	-	3	2	5	80	20	50E	
27	Project- 2	MEG405	GPRO	4	MEG404		4	4				100E
28	Entrepreneurship Development	CCG501	GESU	5	-	2	2	4				50I
29	Internship 2 (3 weeks -After FIFTH Semester During Winter Vacation)	CCG503	GINT	5			2	2			50E	
30	Indian Constitution	CCG206	GINC	2		2		0				

Note: Separate *Supplementary Input Sessions* for necessary content of First Year courses shall be designed and arranged for these students so as to bridge the gap of FY courses

Path-3 -Branch Change Path Structure

Sr. No.	Name of Course	Course Code	Course Abbreviation	Level	Pre-requisite Course	Teaching Scheme (hours per week)			Examination Scheme (marks)			
						TH	PR. / DRG / Tut	Credits	TH	TS	PR	OR
	Semester 3											
1	Applied Mathematics	MEG301	GAMT	3	CCG105, CCG106	3	1	4	80	20		
2	Machine Drawing	MEG303	GMDR	3	CCG107	3	2	5	80	20		50E
3	Manufacturing Processes	MEG304	GMPR	3	-	3	4	7	80	20	50E	
4	Strength of Materials	MEG305	GSOM	3	CCG110	3	2	5	80	20		50E
5	Basic Electrical and Electronics Engineering	MEG309	GBEE	3	-	4	2	6	80	20	50I	
6	Computer Aided Drafting	MEG315	GCAD	3	-	0	4	4			50E	
7	Essence of Indian Traditional Knowledge	CCG205	GITK	2		2		0				
	Semester 4											
8	Thermal Engineering	MEG302	GTEG	3	-	3	2	5	80	20		50E
9	Machine Tools	MEG306	GMTL	3	-	3	4	7	80	20	75E	
10	Theory of Machines	MEG308	GTOM	3	-	3	2	5	80	20		50E
11	Engineering Metallurgy and Materials	MEG310	GEMM	3	-	3	2	5	80	20	50I	
12	Engineering Metrology	MEG314	GEME	3	-	3	2	5	80	20	50I	
13	Mechanical Engineering Measurements	MEG316	GMEM	3	-	3	2	5	80	20	50I	
14	Solid Modeling	MEG414	GSMD	4	-	1	2	3			50E	
	Semester 5											
15	Power Engineering	MEG401	GPEG	4	MEG302	4	2	6	80	20		50E
16	Machine Design	MEG402	GMDN	4	MEG305	4	2	6	80	20		50E
17	Advanced Machining Processes	MEG403	GAMP	4		2	4	6	80	20		50I
18	Fluid Mechanics & Machinery	MEG406	GFMM	4	-	4	2	6	80	20	50E	
19	Elective-1< MEG416 TO MEG418> (Any One)	-	-	4	-	3	2	5	80	20		50I
20	Mechatronics and Robotics	MEG415	GMTR	4	-	2	2	4			50I	
21	Project- 1	MEG404	GPRT	4	-		2	2				50I
22	Internship 1 (4 weeks -After FOURTH Semester During Summer Vacation)	CCG502	GINO	5			3	3			50E	
	Semester 6											
23	Industrial Org. And Management	MEG501	GIOM	5	-	3		3	80	20		
24	Industrial Engineering	MEG503	GIEG	5	-	3	2	5	80	20		50I
25	Elective-2< MEG504 TO MEG506> (Any One)	-	-	5	-	3	2	5	80	20		50E
26	Elective-3< MEG507 TO MEG509> (Any One)	-	-	5	-	3	2	5	80	20	50E	
27	Project- 2	MEG405	GPRO	4	MEG404		4	4				100E
28	Entrepreneurship Development	CCG501	GESU	5	-	2	2	4				50I
29	Internship 2 (3 weeks -After FIFTH Semester During Winter Vacation)	CCG503	GINT	5			2	2			50E	
30	Indian Constitution	CCG206	GINC	2		2		0				

6. EXEMPTIONS FOR COURSES

6.1 Eligibility for Exemptions for First and Second Semester Courses of MPECS-2020 for students admitted on X-pass basis

S N	Name of Course	Course Code	Whether eligible for exemption? (Yes / No)				
			XII Science	XII Tech.	XII MCVC	XII Voc.	ITI
1	Engineering Physics (CE/ME/MT)	CCG101	**YES**	**YES**	No	No	No
2	Engineering Physics (EE/IE/ET/IT)	CCG102	**YES**	**YES**	No	No	No
3	Engineering Chemistry (CE/ME/MT)	CCG103	No	No	No	No	No
4	Engineering Chemistry (EE/IE/ET/IT)	CCG104	No	No	No	No	No
5	Basic Mathematics	CCG105	**YES**	**YES**	No	**YES**	No
6	Engineering Mathematics (CE/ME/MT)	CCG106	**YES**	**YES**	No	**YES**	No
7	Engineering Drawing -1 (CE/ME/MT)	CCG107	No	**YES**	No	No	No
8	Engineering Drawing -2 (CE/ME/MT)	CCG108	No	**YES**	No	No	No
9	Engineering Graphics (EE/IT/IE/ET)	CCG109	No	**YES**	No	No	No
10	Applied Mechanics	CCG110	No	No	No	No	No
11	Workshop Practices–1 (CE)	CCG111	No	**YES**	**YES**	**YES**	**YES**
12	Workshop Practices–1 (ME/MT)	CCG112	No	**YES**	**YES**	**YES**	**YES**
13	Workshop Practices (EE)	CCG113	No	**YES**	**YES**	**YES**	**YES**
14	Workshop Practices (IE/ET)	CCG114	No	**YES**	**YES**	**YES**	**YES**
15	Workshop Practices -2 (CE)	CCG115	No	**YES**	**YES**	**YES**	**YES**
16	Workshop Practices -2 (ME/MT)	CCF116	No	**YES**	**YES**	**YES**	**YES**
17	Engineering Mathematics (EE/IE/ET/IT)	CCG118	**YES**	**YES**	No	**YES**	No
18	Communication Skills in English	CCG203	No	No	No	No	No

Note: The above eligibility is subject to condition that the student has secured at least 40 % marks in the respective subject.
Students seeking exemption for any other subjects should contact Academic Coordinator/ Controller of Examinations.

6.2 First year courses exempted and Credits allotted for Direct Second Year Admission

Sr. No.	Name of Course	Course Code	Course Abbreviation	Level	Pre-requisite Course	Teaching Scheme (hours per week)			Examination Scheme (marks)			
						TH	PR. / DRG / Tut	Credits	TH	TS	PR	OR
	Semester 1											
1	Engineering Chemistry	CCG103	GCHA	1	-	3	2	5	80	20	50	
2	Basic Mathematics	CCG105	GBMT	1	-	3	1	4	80	20		
3	Engineering Drawing – 1	CCG107	GEDA	1	-	3	2	5	80	20	25	
4	Communication Skills in English	CCG203	GCMS	2	-	3	2	5	40	10	50	
5	Workshop Practice-1	CCG112	GWSB	1	-		2	2			50	
6	Sports and Yoga	CCG117	GSPY	1	-		2	2				
7	Environmental Science	CCG204	GEVS	2		2		0				
	Semester 2											
8	Engineering Physics	CCG101	GPHA	1	--	3	2	5	80	20	50	
9	Engineering Mathematics	CCG106	GEMT	1	CCG105	3	1	4	80	20		
10	Engineering Drawing – 2	CCG108	GEDB	1	CCG107	3	2	5	80	20	25	
11	Applied Mechanics	CCG110	GAPM	1	--	3	2	5	80	20	25	
12	Workshop Practices – 2	CCG116	GWSF	1	CCG112	0	2	2			50	
13	Introduction to IT System	CCG201	GITS	2	-	2	2	4			50	

7. COURSE EQUIVALENCE FOR PREVIOUS MPECS's

SN	MPECS-1994	MPECS-2001	MPECS-2006	MPECS-2010	MPECS-2013	MPECS-2016	MPECS-2020
1	---	---	R101-Generic Skill	X101-Generic Skill	CCE201-Generic Skills	CCF201-Generic Skills	NIL
2	101-Comm. Skill	0101-Comm. Skills. - I	R102-Comm. Skills	X106-Comm. Skills	CCE202-Comm. Skills	CCF202-Comm. Skills	CCG203-Comm. Skills in English
3	102 Comm. skill –II	102 Comm. skill –II	R102 Comm. skills	X106 Comm. Skills	CCE202 Comm. Skill	CCF202 Comm. Skill	CCG203-Comm. Skills in English
4	103 Applied Physics	0103 Applied physics-I 0104 Applied physics II	R103 Applied Physics-I R104 Applied Physics II	X102 Basic Physics X108 Applied Physics	CCE101 Engineering Physics	CCF101 Engineering Physics	CCG101-Engineering Physics
5	103 Applied Chemistry	0103 Applied Chemistry-I 0104 Applied Chemistry -II	R103 Applied Chemistry-I R104 Applied Chemistry–II	X102 Basic Chemistry X108 Applied Chemistry	CCE103 Chemistry of Engineering materials	CCF103 Chemistry of Engineering materials	CCG103-Engineering Chemistry
6	105 Mathematics-I	0107 Mathematics- I	R107 Basic Mathematics	X104 Basic Mathematics	CCE105 Basic Mathematics	CCF105 Basic Mathematics	CCG105- Basic Mathematics
7	106 Mathematics- II	0108 Mathematics-II	R108 Engineering Mathematics	X110 Engineering Mathematics	CCE106 Engineering Mathematics	CCF106 Engineering Mathematics	CCG106-Engineering Mathematics
8	107 Applied Mechanics	0116 Applied Mechanics	R112 Applied Mechanics.	X111 Applied Mechanics	CCE110 Applied Mechanics	CCF110 Applied Mechanics	CCG110-Applied Mechanics
9	108 Introduction to Computers	0115 Introduction To Computers	R111 Computer Fundamentals & Application.	NIL	NIL	NIL	CCG201-Introduction to IT System
10	109 Engineering Drawing-I	0109 Engineering Drawing-I	R109 Engineering Drawing-I	X105 Engineering Drawing-I	CCE107 Engineering Drawing-1	CCF107 Engineering Drawing-1	CCG107-Engineering Drawing - 1
11	110 Engineering Drawing-II	0110 Engineering Drawing-II	R110 Engineering Drawing-II	X107 Engineering Drawing-II	CCE108 Engineering Drawing-2	CCF108 Engineering Drawing-2	CCG108-Engineering Drawing - 2
12	111 Workshop–I	0113 Workshop –I	R113 Workshop Practice-I	ME101 Basic Workshop Practice (ME)	CCE112 Workshop Practice-1	CCF112 Workshop Practice-1	CCG112 - Workshop Practice-1
13	112 Workshop–II	0114 Workshop -II	R114 Workshop Practice-II	ME102 Workshop Practice (ME)	CCE116-Workshop Practice-2	CCF116-Workshop Practice-2	CCG116-Workshop Practices 2
14	---	0111 Fundamentals of Engineering-I	NIL	NIL	MEE101 Fundamental of Mechanical Engineering	NIL	NIL
15	---	0112 Fundamentals of Engineering-II	NIL	NIL		NIL	NIL
16	M201 Mathematics-III	2201 Mathematics-III	M201 Applied Mathematics	ME201 Mathematics	MEE301 Applied Mathematics	MEF301 Applied Mathematics	MEG301-Applied Mathematics
17	M202 Power Engineering-I	2202 Thermal Engineering	M202 Thermal Engineering	ME202 Thermal Engineering	MEE302 Thermal Engineering	MEF302 Thermal Engineering	MEG302-Thermal Engineering

18	M203 Machine Drawing-I	2203 Machine Drawing	M203 Machine Drawing	ME203 Machine Drawing	MEE303 Machine Drawing	MEF303 Machine Drawing	MEG303-Machine Drawing
SN	**MPECS-1994**	**MPECS-2001**	**MPECS-2006**	**MPECS-2010**	**MPECS-2013**	**MPECS-2016**	**MPECS-2020**
19	M204-Manufacturing Process-I	2204-Manufacturing Processes	M204-Manufacturing Processes	ME204-Manufacturing Processes	MEE304 - Manufacturing Processes	MEF304-Manufacturing Processes	MEG304-Manufacturing Processes
20	M205 Strength of Materials	2205 Theory of Engineering Design	M205 Theory of Engineering Design	ME205 Theory of Engineering Design	MEE305 Theory of Engineering Design	MEF305 Theory of Engineering Design	MEG305-Strength of Materials
21	M206 Machine Tools -I	2206 Machine Tools	M206 Production Processes.	ME206 Production Processes.	MEE306 Machine Tools	MEF306 Machine Tools	MEG306-Machine Tools
22	M207 Machine Drawing- II	2207 Production Drawing	NIL	NIL	NIL	NIL	NIL
23	M208 Mechanisms	2208 Mechanisms	M208 Theory of Machines & Mechanisms.	ME208 Theory of Machines & Mechanisms.	MEE308 Theory of Machines & Mechanisms.	MEF308 Theory of Machines & Mechanisms.	MEG308 Theory of Machines
24		2209 Electrical Technology	M209 Electrical Technology	ME209 Electrical Technology	MEE309 Electrical Technology	MEF309 Electrical Technology	NIL
25	M209 Engineering Materials	2211 Engineering Materials	--	--	-	-	-
26	M210 Heat Transfer	2212 Heat Transfer	--	--	-	-	-
27	M211 Engineering Metallurgy	2213 Engineering Metallurgy	M210 Engg. Materials & Metallurgy	ME210 Engg Materials & Metallurgy	MEE310 Engg. Metallurgy and Materials	MEF310 Engg. Metallurgy and Materials	MEG310- Engg. Metallurgy and Materials
28	---	---	M207 Applied Electronics.	ME207 Applied Electronics.	MEE307Applied Electronics	MEF307 Applied Electronics	NIL
29	---	---	M211 Personality Development.	ME211 Personality Development.	CCE203 Professional Practices	CCF203 Professional Practices	NIL
30	221 Basic Civil Engg.	0221 Elements of Civil Engg.	R221 Elements of Civil Engg.	--	--	--	--
31	222 Basic Electrical Engg.	0222 Electrical Circuits & Machines.	R222 Electrical Circuits & Machines.	----	---	---	--
32	223 Basic Electronics.	0223 Basic Electronics.	R223 Basic Electronics.	----	----	----	--
33	224 Basic Mechanical Engg.	0224 Basic Mechanical Engg.	R224 Basic Mechanical Engg.	----	MEE101 Fundamental of Mechanical Engg	---	--
34	225 Basic Sugar Manufacturing	0225 Basic Sugar Manufacturing	R225 Basic Sugar Manufacturing	---	---	---	---
35	226 Pollution Control	0226 Pollution Control	R226 Pollution Control	ME212 Pollution Control	MEE311Pollution Control	MEF311 Pollution Control	NIL
36	227 Non-Conventional energy sources.	0227 Non-Conventional Energy Sources.	R227 Non-Conventional energy Sources.	ME213 Non-Conventional energy Sources.	MEE312 Non-Conventional Energy Sources	MEF312 Non-Conventional Energy Sources	NIL

37	228 Higher Mathematics	0228 Higher Mathematics	R228 Higher Mathematics	ME214 Higher Mathematics	MEE313 Higher Mathematics	MEF313 Higher Mathematics	NIL

SN	MPECS-1994	MPECS-2001	MPECS-2006	MPECS-2010	MPECS-2013	MPECS-2016	MPECS-2020
38	M301 Power Engineering-II	2301Power Engineering	M301Power Engineering	ME301Power Engineering	MEE401 Power Engineering	MEF401 Power Engineering	MEG401- Power Engineering
39	M302 Machine Design	2302 Machine Design	M302 Machine Design	ME302 Machine Design	MEE402 Machine Design	MEF402 Machine Design	MEG402- Machine Design
40	M303 Machine Tools –II	2305CNC Machine Tools	M303Advance Machining Processes.	ME303Advance Machining Processes.	MEE403 Advanced Machining Processes	MEF403 Advanced Machining Processes	MEG403- Advanced Machining Processes
41	M304 Project Work & Seminar	---	M304 Seminar	ME304 Seminar	MEE404 Project- I	MEF404 Project- I	MEG404- Project- 1
42	--	304 Industrial Project	M305 Project	ME305 Project	MEE405 Project- II	MEF405 Project- II	MEG405- Project- 2
	M305 Plant Maintenance Engineering	2306 Plant Maintenance Engineering	--	--	-	-	--
43	M 306 Hydraulic Machinery	2307 Hydraulic Machinery	M306Hydraulic Machinery	ME306 Hydraulic Machinery	MEE406 Hydraulic Machinery	MEF406 Hydraulic Machinery	MEG406- Fluid Mechanics and Machinery
44	M 307 Metrology and Quality control	2308 Metrology 2309 Quality Control	M307 Metrology M404 Quality Management	ME307 Metrology ME404 Quality Management	MEE407 Metrology MEE503 Quality Management	MEF407 Metrology MEF503 Quality Management	MEG314- Engineering Metrology MEG418- Total Quality Mgmt.
48	M 308 Advance Machine Tools	2303 Advance Machine Tools	M303 Advanced Machining Processes	ME303 Advanced Machining Processes	MEE403 Advanced Machining Processes	MEF403 Advanced Machining Processes	MEG403- Advanced Machining Processes
49	M 309 Instrumentation	2310 Instrumentation	--	--	-	-	--
50	---	---	M309 Mechanical Measurement & Mechatronics.	ME309 Mechanical Measurement & Mechatronics.	MEE410 Mech. Measurement & Mechatronics	MEF410 Mech. Measurement & Mechatronics	MEG316- Mechanical Engineering Measurements MEG415- Mechatronics and Robotics
51	--	--	M310 Marketing Management	ME310 Marketing Management	MEE411 Marketing Management	MEF411 Marketing Management	MEG416- Marketing Management
52	--	--	M311 Alternative Energy Sources.	ME311Alternative Energy Sources.	MEE312 Non-Conventional Energy Sources	MEF312 Non-Conventional Energy Sources	NIL
53	M401 Computer Programming	2401 Computer Programming	M401 Computer Programming	ME401 Computer Programming	MEE408 Computer Programming	MEF408 Computer Programming	NIL

54	M402 Computer Application	2402 Computer Application	M402 Computer Application	ME402 Computer Application	MEE409 Computer Application	MEF409 Computer Application	MEG315- Computer Aided Drafting MEG414- Solid Modeling
55	M403 Ind. Org. And Management	2403 Ind. Org. And Management	M403 Ind. Org. And Management	ME403 Ind. Org. And Management	MEE50 Industrial Org. And Mgmt.	MEF502 Industrial Org. And Mgmt.	MEG501- Industrial Org. And Mgmt.
SN	**MPECS-1994**	**MPECS-2001**	**MPECS-2006**	**MPECS-2010**	**MPECS-2013**	**MPECS-2016**	**MPECS-2020**
56	M 404 Entrepreneurship	2404 Entrepreneurship	M308 Career & Entrepreneurship Development	ME308 Career & Entrepreneurship Development	MEE501 Entrepreneurship Development	MEF501 Entrepreneurship Development	CCG501- Entrepreneurship Development
57	M405 Production Engineering	2405 Production Engineering	--	--	-	-	--
58	M 406 Industrial Engineering	2406 Industrial Engineering	M405 Industrial Engineering	ME405 Industrial Engineering	MEE504 Industrial Engineering	MEF504 Industrial Engineering	MEG503- Industrial Engineering
59	M407 Material Management	2407 Material Management	M407 Material Management	ME407 Material Management	MEE506 Material Handling System	--	--
60	M408 Foundry Technology	2408 Foundry Technology	M408 Foundry Technology	ME408 Foundry Technology	MEE507 Foundry Technology	MEF507 Foundry Technology	MEG504- Foundry Technology
61	M409 Refrigeration and Air Conditioning	2409 Refrigeration and Air Conditioning	M409 Refrigeration and Air Conditioning	ME409 Refrigeration and Air Conditioning	MEE508 Refrigeration & Air Conditioning	MEF508 Refrigeration &Air Conditioning	MEG505- Refrigeration & air conditioning
62	M 410 Automobile Engg.	2410 Automobile Engg.	M410 Automobile Engg.	ME410 Automobile Engg.	MEE509 Automobile Engineering	MEF509 Automobile Engineering	MEG506- Automobile Engineering
63	M 411 Industrial Safety	2412 Industrial Safety	--	--	-	-	--
64	M413 Estimation and Costing	2413 Estimation and Costing	--	--	-	-	--
65	-------	2411 Industrial Hydraulics & Pneumatics.	M411 Industrial Hydraulics & Pneumatics.	ME411 Industrial Hydraulics & Pneumatics.	MEE510 Industrial Hydraulics &Pneumatic	MEF510 Industrial Hydraulics &Pneumatic	MEG507- Industrial Hydraulics & Pneumatics
66	-----	----	M404 Quality Management	ME404 Quality Management	MEE503 Quality Management	MEF503 Quality Management	MEG418- Total Quality Mgmt.
67	----	----	M406 Quality Systems	ME406 Quality Systems	MEE412 Quality Systems	MEF412 Quality Systems	NIL
68	----	----	M412 Tool Engineering	ME412 Tool Engineering	MEE511 Tool Engineering	MEF511 Tool Engineering	MEG508- Tool Engineering
69	----	----	M413 Welding Technology	ME413 Welding Technology	MEE512 Welding Technology	MEF512 Welding Technology	MEG509 Welding Technology

8. PROFORMAS FOR EVALUATION OF TERM WORK, ORALS AND PRACTICALS

PROFORMA – I

GOVERNMENT POLYTECHNIC, KOLHAPUR
Performance for Final Assessment of PRACTICAL / ORAL
FOR COURSES OF FIRST AND SECOND SEMESTER (Without Micro-Projects)

By Internal & External Examiner

(For Course having ONLY PRACTICAL / ORAL)

Course Code & Course Name: -_____

Programme: -_____

Sr. No.	Roll No./ Exam. Seat No.	Marks of Progressive Skill Test	Marks of Continuous Assessment	Performance of Term End PR/OR by Internal Examiner	Performance of Term End PR/OR by External Examiner	Marks Out of (Total of Col.2 to 5)	Marks As per Evaluation Scheme (as mention in exam. Scheme)
	Column No-1	2	3	4	5	6	7
	Max. Marks Allotted	25	25	25	25	100	

Summer/Winter Exam-20_____Date: -_____

Internal Examiner

Signature: -

Name: -

Institute: -

External Examiner

Signature: -

Name: -

Institute: -

PROFORMA–II

GOVERNMENT POLYTECHNIC, KOLHAPUR
Performance for Final Assessment of PRACTICAL / ORAL
FOR COURSES OF FIRST AND SECOND SEMESTER (Without Micro-Projects)

By Internal Examiner

(For Course having ONLY PRACTICAL / ORAL)

Course Code & Course Name: -_____
Programme: -_____
Summer/Winter Exam-20_____Date: -_____

Sr. No.	Roll No./ Exam. Seat No.	Marks of Progressive Skill Test	Marks of Continuous Assessment	Performance of Term End PR/OR by Internal Examiner	Marks out of (Total of Col.2 to 4)	Marks As per Evaluation Scheme (as mention in exam. Scheme)
	Column No-1	2	3	4	5	6
	Max. Marks Allotted	25	25	50	100	

Internal Examiner

Signature: -

Name: -

Institute: -

PROFORMA – III

GOVERNMENT POLYTECHNIC, KOLHAPUR
Performance for Final Assessment of PRACTICAL / ORAL
FOR COURSES OF THIRD TO SIXTH SEMESTER (With Micro-Projects)
By Internal & External Examiner
(For Course having ONLY PRACTICAL / ORAL)

Course Code & Course Name: -_____
Programme: -_____
Summer/Winter Exam-20_____Date: -_____

Sr. No.	Roll No./ Exam. Seat No.	Marks of Progressive Skill Test	Marks of Continuous Assessment	Marks As per Evaluation Scheme for micro-project (To be assessed by internal examiner)	Performance of Term End PR/OR by Internal Examiner	Performance of Term End PR/OR by External Examiner	Marks Out of (Total of col.2 to 6)	Marks As per Evaluation Scheme (As mention in exam. Scheme)
	Column no.1	2	3	4	5	6	7	8
	Max. Marks Allotted	25	25	25	25	25	125	

Internal Examiner

Signature: -

Name: -

Institute: -

External Examiner

Signature: -

Name: -

Institute: -

PROFORMA–IV

GOVERNMENT POLYTECHNIC, KOLHAPUR
Performance for Final Assessment of PRACTICAL / ORAL
FOR COURSES OF THIRD TO SIXTH SEMESTER (With Micro-Projects)

By Internal Examiner

(For Course having ONLY PRACTICAL / ORAL)

Course Code & Course Name: -_____
Programme: -_____
Summer/Winter Exam-20_____Date: -_____

Sr. No.	Roll No./ Exam. Seat No.	Marks of Progressive Skill Test	Marks of Continuous Assessment	Marks As per Evaluation Scheme for micro-project (to be assessed by internal examiner)	Performance Of Term End PR/OR by Internal Examiner	Marks out of (Total of col.2 to 5)	Marks As per Evaluation Scheme (as mention in exam. Scheme)
	Column no.1	2	3	4	5	6	7
	Max. Marks Allotted	25	25	25	50	125	

Internal Examiner

Signature: -

Name: -

Institute: -

SECTION – II
SYLLABI OF COURSES (LEVEL-WISE)

LEVEL – I
FOUNDATION COURSES

COURSE ID: ME

Course Name : ENGINEERING PHYSICS (CE/ME/MT)
Course Code : CCG101
Course Abbreviation: GPHA

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks for each practical ii) One PST of 25 marks	Term End Theory Exam (03 hours)	Term End Practical Exam (02 hours)	
Marks	**20**	As per proforma II	**80**	**50 I**	**150**

I – Internal Assessment

2. RATIONALE:

Physics is the foundation of engineering and technology. The development of all engineering areas requires good understanding of fundamental principles in physics. Studying physics develops scientific methodology and technical aptitude in the students. Applications of principles of physics in engineering fields create interest and motivate the students.

3. COMPETENCY:

Apply principles of Physics to solve engineering problems as follows:

a) Cognitive : i) Understanding and applying principles and laws of Physics to simple practical problems/ situations ii) Observing iii) Classifying iv) Interpreting

b) Psychomotor: Handling of instruments, apparatus and tools

c) Affective : Skill of i) working in team ii) curiosity, interest and self-confidence

4. COURSE OUTCOMES:

CCG101-1 Estimate errors in measurement of physical quantities.

CCG101-2 Select proper material in engineering industry by analysis of its physical properties

CCG101-3 Use basic principles of wave motion for related engineering applications

CCG101-4 Apply principles of optics, electricity to solve engineering problems

CCG101-5 Express importance of Lasers, X-rays and nanotechnology.

CCG101-6 Apply principles of acoustics and ultrasonics for related engineering applications

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 design/ development of solutions	PO 4 Engineering Tools, experimentation and testing	PO 5 Engineering practice for society, sustainability and environment	PO 6 Project management	PO 7 Life-long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial ativity
Competency:	3	1	1	2	1	1	2		
CCG101-1	3	1	1	2	-	1	2		
CCG101-2	3	1	1	2	1	1	2		
CCG101-3	3	1	1	2	1	1	2		
CCG101-4	3	1	2	2	2	1	2		
CCG101-5	3	1	1	1	2	1	1		
CCG101-6	3	1	1	1	1	1	2		

6. CONTENT:

A) LABORATORY WORK: Laboratory work shall consist of the following:

Minimum 10 required **(* represents as experiments to be carried out compulsory and 02 experiments should be from the remaining list)**

List of Laboratory experiments and related skills to be developed: (Each experiment 02 hours)

Sr. No	Title of Experiment	Skills to be developed	Course Outcome
*1	To measure internal and external dimensions of hollow cylinder by using Vernier Caliper	i) Going through safety measures required ii) Determine least count and zero error in the measuring instrument. iii) Measuring internal and external dimensions of given objects iv) Handling the measuring instruments for measuring depth, thickness etc. v) Tabulating observations and calculations vi) Interpreting results	CCG101-1
*2	To measure the diameter of bob and thickness of plate by using Vernier Caliper	i) Going through safety measures required ii) Determine least count and zero error in the measuring instrument. iii) Measuring dimensions of given objects iv) Handling the measuring instruments for measuring depth, thickness etc. v) Tabulating observations and calculations vi) Interpreting results	CCG101-1
*3	To measure the diameter of bob and thickness of plate by using Micrometer screw gauge	i) Going through safety measures required ii) Determine least count and zero error in the measuring instrument. iii) Measuring dimensions of given objects iv) Handling the measuring instruments for measuring depth, thickness etc.	CCG101-1

		v) Tabulating observations and calculations vi) Interpreting results	
*4	To determine the viscosity of liquid by Stokes's method.	i) Going through safety measures required ii) Measuring diameter of steel ball using micrometer screw gauge. iii) Measuring terminal velocity of steel ball in the liquid column. iv) Use of stop watch for measurement of time. v) Tabulating observations and calculations vi) Interpreting results	CCG101-2
5	To determine the buoyancy force on a solid immersed in a liquid	i) Going through safety measures required ii) Measuring dimensions of given solid using vernier caliper or micrometer screw gauge. iii) Measuring the volume of liquid collected iv) Tabulating observations and calculations v) Interpreting results	CCG101-2
*6	To measure unknown resistance of wire by Ammeter – Voltmeter method.	i) Going through safety measures required ii) Drawing the circuit diagram of the required experiment. iii) Connecting the instruments as per circuit diagram. iv) Measuring the value of potential difference & current in the circuit. v) Tabulating observations and calculations vi) Interpreting results	CCG101-4
*7	To verify Snell's law using glass slab	i) Going through safety measures required ii) Drawing necessary ray diagram iii) Measuring angles of incidence and refraction iv) Tabulating observations and calculations v) Interpreting results	CCG101-4
*8	To determine refractive index of prism by pin method	i) Going through safety measures required ii) Removing parallax between images and pins iii) Measuring the angle of refraction correctly iv) Drawing path of refracted ray through prism v) Drawing i-δ graph vi) Tabulating observations and calculations vi) Interpreting results	CCG101-4
9	To study Total Internal Reflection using glass slab	i) Going through safety measures required ii) Drawing necessary ray diagram iii) Measuring angles of incidence and refraction iv) Tabulating observations and calculations v) Interpreting results	CCG101-4
10	To determine velocity of sound by resonance tube	i) Going through safety measures required ii) Adjusting the resonating length by discriminating resonating sound from sound produced by the tuning fork.	CCG101-3

		iii) Measuring internal diameter of resonating tube using vernier caliper iii) Drawing inference & confirming Law nL = constant iv) Tabulating observations and calculations v) Interpreting results	
11	To determine the acceleration due to gravity by 'g' by simple pendulum	i) Going through safety measures required ii) Measuring length of pendulum iii) Finding least count of stopwatch iii)Measuring periodic time with the help of stop watch iv) Tabulating observations and calculations v) Interpreting results	CCG101-3
*12	To measure unknown resistance by Wheatstone's meter bridge.	i) Going through safety measures required ii) Drawing the circuit diagram for the experiment iii)Connecting the resistances as per circuit diagram. iii) Finding the correct position of null point & measuring correct balancing lengths on Meter bridge. iv)Tabulating observations and calculations v) Interpreting results	CCG101-4
13	To verify series law of resistances by Wheatstone's meter bridge.	i) Going through safety measures required ii) Drawing the circuit diagram for series connections of the resistances. iii)Connecting the resistances for series method as per circuit diagram. iii) Finding the correct position of null point & measuring correct balancing lengths on Meter bridge. iv)Tabulating observations and calculations v) Interpreting results	CCG101-4
14	To parallel law of resistances by Wheatstone's meter bridge.	i) Going through safety measures required ii) Drawing the circuit diagram for parallel connections of the resistances. iii)Connecting the resistances for parallel method as per circuit diagram. iii) Finding the correct position of null point & measuring correct balancing lengths on Meter bridge. iv)Tabulating observations and calculations v) Interpreting results	CCG101-4
15	To be added by the subject teacher as per requirement		

B) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG101-1 *Estimate errors in measurement in Physical quantities*			
1	**UNITS AND MEASUREMENT** 1.1 Unit, Physical Quantities: Fundamental and Derived Quantities and their units 1.1 Systems of units: CGS, MKS, FPS and SI 1.1 Errors, Types of errors: Instrumental, Systematic and Random error, Estimation of errors: Absolute, Relative and percentage errors 1.1 Significant figures 1.1 **Simple Numerical problems**	06	10
Course Outcome CCG101-2 *Select proper material in engineering industry by analysis of its physical properties*			
2	**ELASTICITY** 2.1 Definitions of elasticity, plasticity, rigidity, deforming force, restoring force 2.2 Stress, Strain and their types 2.3 Elastic Limit, Statement of Hooke's law, modulus of elasticity and its types 2.4 Relation between Y, K and η (No derivation) 2.5 Ultimate stress, breaking stress, Working stress, Factor of safety 2.6 Applications of elasticity 2.7 **Simple Numerical problems**	06	10
3	**VISCOSITY** 3.1 Definition and meaning of viscosity, velocity gradient 3.2 Newton's law of viscosity, Coefficient of viscosity 3.3 Stokes law 3.4 Derivation of expression for coefficient of viscosity of liquid by Stokes's method 3.5 Applications of viscosity. **No Numericals on above topic**	06	08
Course Outcome CCG101-3 *Use basic principles of wave motion for related engineering applications*			
4	**WAVE MOTION** 4.1 Definitions of periodic motion, Linear S. H. M. 4.2 Parameters of linear SHM: Amplitudes, Period, Frequency and Phase 4.3 Characteristics of linear SHM 4.4 Concept and definition of wave 4.5 Parameters of wave- Frequency, periodic time,	06	12

	phase and wavelength 4.6 Types of waves (transverse and longitudinal) and their characteristics 4.7 Free and forced oscillations 4.8 Phenomenon of resonance and its applications **No Numericals on above topic**		
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Subtopics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG101-4 *Apply principles of optics, electricity to solve engineering problems*			
5	**PROPERTIES OF LIGHT** 5.1 Refraction of light 5.2 Laws of Refraction of Light, Snell's law 5.3 Refraction through glass prism 5.4 Derivation of prism formula 5.5 Dispersion & Dispersive Power (in terms of angles of deviation only) 5.6 **Simple Numerical problems**	06	08
6	**ELECTRICITY** 6.1 Concept of electric current, resistance 6.2 Ohm's law, Specific resistance 6.3 Resistances in series and parallel. 6.4 Wheatstone's Network and Meter Bridge. 6.5 **Simple Numerical problems**	**06**	**10**
Course Outcome CCG101-5 *Express the importance of Lasers, X-rays and nanotechnology.*			
7	**MODERN PHYSICS** **7.1 LASER** 7.1.1 Introduction of LASER 7.1.2 Properties of laser 7.1.3 Spontaneous and stimulated emission 7.1.4 Population inversion and optical pumping 7.1.5 Applications of LASER **No numericals on above topic** **7.2 X-RAYS** 7.2.1 Nature and properties of x-rays. 7.2.2 Production of x-rays by Coolidge tube 7.2.3 Applications of x-rays **No numericals on above topic** **7.3 INTRODUCTION TO NANOTECHNOLOGY** 7.3.1 Definition of nanoscale, nanometer, nanoparticle 7.3.2 Definition and examples of nanostructured materials	**08** (03) (03) (02)	**14** (06) (04) (04)

	7.3.3 Applications of nanotechnology in electronics, automobile, textile, space, medicine, cosmetics and environment **No numericals on above topic**		
Course Outcome CCG101-6 *Apply principles of acoustics and ultrasonics for related engineering applications*			
8	**ACOUSTICS AND ULTRASONICS** **8.1 ACOUSTICS** 8.1.1 Echo and reverberation of sound 8.1.2 Sabine's formula 8.1.3 Requirements of good acoustics 8.1.4 Acoustical planning of an auditorium 8.1.5 **Simple Numerical Problems** **8.2 ULTRASONICS** 8.2.1 Limits of audibility 8.2.2 Ultrasonic waves 8.2.3 Ultrasonic transducers: Piezoelectric and Magnetostriction 8.2.4 Applications of ultrasonic waves **No numerical on above topic**	**04**	**08**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total marks
		Remember	Understand	Apply		
I/1	Units and Measurement	2	4	4	CCF101-1	10
I/2	Elasticity	2	2	6	CCF101-2	10
I/3	Viscosity	2	2	4	CCF101-2	08
I/4	Wave motion	4	8	-	CCF101-3	12
II/5	Properties of light	2	2	4	CCF101-4	08
II/6	Electricity	2	2	6	CCF101-4	10
II/7	Modern Physics	4	4	6	CCF101-5	14
II/8	Acoustics and Ultrasonics	2	4	2	CCF101-6	08
	Total	**20**	**28**	**32**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8.ASSESSMENT CRITERIA FOR PRACTICAL WORK AND PRACTICAL EXAMINATION

a) Assessment Criteria for Practical work:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per given criteria.

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Observations, calculations & Result table	05
Psychomotor	Operating Skills	05
	Neat & complete circuit Diagram / schematic Diagram.	05
Affective	Discipline and punctuality Decency and presentation	05
TOTAL		25

ii) Criteria for Progressive skill Test:

One mid-term Progressive Skill Test of 25 marks shall be conducted as per criteria given below

Sr. No.	Criteria	Marks allotted
1	Neat & complete circuit Diagram / schematic Diagram.	05
2	Observations & Result Table	05
3	Sample Calculations with relevant Formulae.	05
4	Proper Graphs & Procedure / workmanship Safety measures	05
5	Oral Based on Practical Work	05
	Total	25

b) Criteria for assessment at term end practical exam:

Every student has to perform one practical within 2 hours at term end practical exam which shall be assessed as per following criteria.

Sr. no.	Criteria	Marks allotted
1	Preparedness for practical	10
2	Correct figures / diagrams	10
3	Observation tables	10
4	Result table / calculations / graphs	10
5	Safety / use of proper tools	10
	Total	50

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Discussions
ii) Regular Home Assignments.
iii) Laboratory work

Teaching and Learning resources:

i) Chalk board
ii) Video clips
iii) Slides
iv) Item Bank
v) Charts

10. REFERENCE MATERIAL:

a) Books / Code

Sr. No.	Author	Title	Publisher
1	Narlikar	Text book of Physics for class XI & XII (Part-I, Part-II)	N.C.E.R.T Delhi
2	P.V.Naik.	Engineering Physics	Pearson Edu. Pvt. Ltd, New Delhi.
3	Narkhede, Pawar, Sutar	Concepts in Physics, Vol. I & II.	Bharti Bhawan Ltd, New Delhi.
4	Walker, Halliday, Resnick	Principles of Physics.	Wiley Publication, New Delhi.
5	B.L. Theraja	Engineering Physics	S. Chand Publishers – New Delhi
6	Beiser	Concept of modern physics	Tata Mc-Graw Hill
7	E. Zebro Wski	Physics for Technicians	Tata Mc-Graw Hill
8	V. Rajendran	Engineering Physics	Tata McGraw-Hill Publications

b) Websites:

i) http://www.physicsclassroom.com
ii) http://scienceworld.wolfram.com/physics/
iii) http://physics.about.com/
iv) http://nptel.ac.in/course.php?disciplineId=115
v) http://nptel.ac.in/course.php?disciplineId=104
vi) www.fearofphysics.com
vii) www.science.howstuffworks.com

* * *

COURSE ID: ME

Course Name : ENGINEERING CHEMISTRY (CE/ME/MT)
Course Code : CCG103
Course Abbreviation : GCHA

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <nil>

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	Practical assignment (CA) One Skill Test (2 hours)	Term End Theory Exam (03 hours)	Term End Practical Exam (02 hours)	
Marks	**20**	As per proforma II	**80**	**50 I**	**150**

I – Internal Assessment

2. RATIONALE:

Basic science such as Chemistry is the fundamental of Engineering & technology. It is most essential to learn the basic science to understand the fundamental concepts in Engineering & technology. Engineering chemistry deals with the study of structure, composition & properties of the materials, which form the core of the fundamental science. Many processes are based on principle of Chemistry in various industries. Topics such as Water, Electrochemistry, Corrosion, & protection of metals from corrosion are some of the direct applications of chemistry in engineering. Hence, the knowledge of chemistry is essential to the aspiring engineers of all branches in their field. Engineering materials like Steel, Rubber, Plastic, Thermocole, Glass wool, Paints, Lubricants are the backbone of various industries, machines, equipment & processes.

3. COMPETENCY:

Apply the knowledge of chemistry to use the engineering materials for various purposes depending on their chemical properties.

a) Cognitive : Understanding & applying properties of chemicals in engineering field.
b) Psychomotor: Handling & use of glassware & chemicals. Sketching & labeling diagram of Blast furnace. Experimentally analyzing water samples for preparing potable water by different methods.
c) Affective : i) Accuracy ii) Safety iii) Punctuality iv) Attitude.

4. COURSE OUTCOMES:

1. **CCG103-1** Understand the application of basic concepts in chemistry.
2. **CCG103-2** Apply the knowledge of electrochemistry in industry for electroplating and electro-refining.
3. **CCG103-3** Interpret the reasons of corrosion & remedies by using appropriate techniques.
4. **CCG103-4** Select the relevant catalyst for given application.
5. **CCG103-5** Select insulators, adhesive, composite materials, Plastic & rubber for different applications in the field of engineering
6. **CCG103-6** Use relevant water treatment process to solve industry problems.
7. **CCG103-7** Understand the method of extraction of Iron.
8. **CCG103-8** Use appropriate lubricant to solve industrial problems.
9. **CCG103-9** Select paint and varnish for different applications in the field of engineering.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-: no correlation**]**

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial ativity
Competency:	3	3	2	2	1	1	1	1	1
CCG103-1	3	3	3	2	-	-	1	2	2
CCG103-2	3	3	2	3	1	1	2	2	2
CCG103-3	3	3	3	2	2	1	1	3	3
CCG103-4	3	2	2	1	1	1	2	1	1
CCG103-5	3	2	2	1	2	1	1	2	2
CCG103-6	3	3	3	2	2	1	1	2	3
CCG103-7	3	3	2	2	2	1	1	2	2
CCG103-8	3	2	2	2	2	1	1	2	2
CCG103-9	3	2	2	2	2	2	1	2	2

6. CONTENT:

A. LABORATORY WORK

Lab work shall consist of the following:

Laboratory experiments and related skills to be developed:

Sr. No.	Title of Experiment	Skills/Competencies to be developed	Course Outcome
1	Introduction to Chemistry laboratory	Awareness of chemicals, glasswares & instruments used in chemistry laboratory	CCG103-1
2	Volumetric analysis of solution.	Molecular weight, equivalent weight, acidity, basicity normality of solution. Awareness of different types of titrations, use of indicators	CCG103-1
3	Preparation of 1 N, 0.5 N & 0.1 N Solutions of different chemicals like NaOH, HCl,	Skill of weighing, handling Glassware & measuring solutions	CCG103-1

	Oxalic acid, $FeSO_4$, etc.		
4	Titration of strong acid and strong bases (HCl X NaOH)	Skills of determining accurate end point of titration & development of measurement skills.	CCG103-1
5	Titration of strong acid, strong base& weak acid (HCI X NaOH X $H_2C_2O_4.H_2O$	Skills of determining accurate end point of titration & development of measurement skills.	CCG103-1
6	Titration of weak base, strong acid & strong base (Na_2CO_3 X H_2SO_4 X KOH	Skills of determining accurate end point of titration & development of measurement skills.	CCG103-1
7	Estimation of chloride content in water by Mohr' s method	Measurement skill utilization of practical data for testing & estimation	CCG103-5
8	Determination of amount of Ca and Mg ions present in given sample of water by E.D.T.A method	Measurement skill utilization of practical data for testing & estimation	CCG103-5
9	Estimation of viscosity of oils by Ostwald's method	Measurement skill utilization of practical data for testing & estimation	CCG103-1
10	Estimation of Ca in limestone.	Measurement skill utilization of practical data for testing & estimation	CCG103-5
11	Titration of $KMnO_4$ & $FeSO_4$ (Redox titration)	Skills of determining accurate end point of titration & development of measurement skills.	CCG103-6
12	Estimation of % of Fe in given sample of steel	Measurement skill utilization of practical data for testing & estimation	CCG103-6
13	Determination of alkalinity of water	Measurement skill utilization of practical data for testing & estimation	CCG103-6

B THEORY:

Section I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
CCG103-1 Understand the application of basic concepts in chemistry.			
1	**ATOMIC STRUCTURE AND CHEMICAL BONDING** 1.1 Atom: Fundamental particles, Nature of atom 1.2 Atomic Number, Mass Number, Isotopes and isobars 1.3 Bohr's theory of atom 1.4 Statement of Hund's rule of maximum multiplicity, Pauli's exclusion principle, Aufbau's principle 1.5 Lewis and Langmuir's concept of stable electronic configuration 1.6 Electovalency and Co-valency 1.7 Formation Of electrovalent compounds- NaCl, $CaCl_2$. 1.8 Formation of Covalent compounds-H_2O, CO_2	**05**	**08**
CCG103-2 Apply the knowledge of electrochemistry in industry for electroplating and electro-refining.			
2	**ELECTROCHEMISTRY** 2.1 Definitions- Conductor, Electrolyte, Electrode, Ionisation, Eletrolysis. 2.2 Arrhenius Theory of Ionisation 2.3 Degree of Ionisation & Factors affecting degree of ionisation. 2.4 Electrolysis of molten NaCl. 2.5 Electrolysis of CuSO4 solution by using Cu-electrodes 2.6 Industrial applications of electrolysis 2.6.1 Electroplating 2.6.2 Electro refining of Cu	**05**	**08**
CCG103-3 Interpret the reasons of corrosion & remedies by using appropriate techniques.			
3.	**CORROSION AND PROTECTIVE COATING** 3.1 Definition & types of corrosion 3.2 Dry or Atmospheric corrosion, Oxide Film Formation & its types, Factors affecting atmospheric corrosion 3.3 Wet or electrochemical corrosion 3.4 Factors influencing immersed corrosion 3.5 Methods of protection of metal from corrosion - Hot dipping (Galvanizing & Tinning), Metal spraying, Metal cladding, Cementation or sherardizing	**04**	**06**
CCG103-4 Select the relevant catalyst for given application.			
4	**CATALYSIS** 4.1 Definition. 4.2 Types of Catalysts with example. - Homogenous catalyst.	**02**	**04**

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	- Heterogenous catalyst 4.3 Promotors. 4.4 Negative catalysis. 4.5 Autocatalysis.		
CCG103-5 Select insulators, adhesive, composite materials, Plastic & rubber for different applications in the field of engineering			
5	**CHEMISTRY OF NONMETALLIC ENGINEERING MATERIALS** **5.1 INSULATORS** 5.1.1 Definition & Characteristics of insulator 5.1.2 Preparation, properties & uses of glass wool, Thermocole. **5.2 COMPOSITE MATERIALS** 5.2.1 Definition & classification. 5.2.2 Properties & Application of composite materials **5.3 PLASTICS** 5.3.1 Definition of Polymer, Polymerization. 5.3.2 Types of polymerizations –Addition & Condensation polymerization. 5.3.3 Classification of plastic – Thermosoftening & thermosetting plastics. 5.3.4 Engineering properties & applications of plastics. **5.4 RUBBER** 5.4.1 Elastomer 5.4.2 Drawbacks of Natural rubber. 5.4.3 Vulcanization of rubber. 5.4.4 Engineering properties & uses of rubber. **5.5 ADHESIVES** 5.5.1 Definition of adhesives. 5.5.2 Characteristics of good adhesive. 5.5.3 Properties of adhesive.	**08**	**14**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Subtopics	Lectures (Hours)	Theory Evaluation (Marks)
CCG103-6 Use relevant water treatment process to solve industry problems.			
6	**WATER** 6.1 Impurities in natural water 6.2 Hard water & Soft water 6.3 Hardness of water- Temporary & Permanent 6.4 Reactions of hard water with soap 6.5 Disadvantages of hard water for domestic & Industrial purpose - Textile Industry, Sugar Industry, Paper Industry, Dying Industry. 6.6 Sterilization of water - Chlorination –by Chlorine gas/water, bleaching powder, chloramine with chemical reactions 6.7 Ion Exchange method to remove total hardness of Water.	**08**	**12**
CCG103-7 Understand the method of extraction of Iron.			
7	**METALLURGY & ALLOYS** 7.1 Occurrence of metals, Definition of minerals, Ore, Flux, Gangue & Slag. 7.2 Flow chart of metallurgical processes. 7.3 Concentration of ores – Physical methods – 1. Gravity separation method 2. Electromagnetic separation method 3. Froth floattion method Chemical methods – 1. Calcination 2. Roasting 7.4 Ores of Iron. 7.5 Extraction of Iron from its ore – Blast furnace – Construction, working, reactions & Products. 7.6 Definition of alloys 7.7 Classification & purposes of making of alloys. 7.8 Composition, properties & engineering application of Non-ferrous alloys – Duralumin, Monal metal & Woods metal. Ferrous alloys – Heat resisting steel, magnetic steel, stainless steel.	**08**	**14**
CCG103-8 Use appropriate lubricant to solve industrial problems.			
8	**LUBRICANTS** 8.1 Definition, classification & functions of lubricants. 8.2 Lubrication & its types – 1. Fluid film lubrication 2. Boundary lubrication 3. Extreme pressure lubrication	**04**	**08**

	8.3 Characteristics of lubricants – Viscosity, Viscosity index, Oiliness, Volatility, Cloud point & Pour point, Flash & Fire point, Acid value.		
CCG103-9 Select paint and varnish for different applications in the field of engineering			
9	**PAINT & VARNISH** 9.1 Oil paint – Definition & characteristics of oil paint. 9.2 Purpose of using oil paint. 9.3 Ingredients of oil paint with suitable example & its functions – Drying oil (Vehicle), Drier, Pigment, Thinner, Filler (Extenders), Plasticizer. 9.4 Varnish – Definition, types, constituents, properties & Applications. 9.5 Distinction between paint & varnish.	**04**	**06**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total marks
		Remember	Understand	Application		
I / 1	Atomic structure and chemical bonding.	06	02	-	CCG103-1	08
I / 2	Electrochemistry.	02	02	04	CCG103-2	08
I /3	Corrosion & protective coating.	02	02	02	CCG103-3	06
I /4	Catalysis.	02	02	-	CCG103-4	04
I/5	Chemistry of non-metallic engineering.	04	06	04	CCG103-5	14
II/6	Water.	04	04	04	CCG103-6	12
II/7	Metallurgy & alloys.	06	06	02	CCG103-7	14
II/8	Lubricants.	04	02	02	CCG103-8	08
II/9	Paint & varnish.	02	02	02	CCG103-9	06
	Total	32	28	20		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL WORK

a) Assessment Criteria for Lab work:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per given criteria.

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Observations, calculations & Result table	05
Psychomotor	Operating Skills	05
	Neat & complete circuit Diagram / schematic Diagram.	05
Affective	Discipline and punctuality Decency and presentation	05
TOTAL		25

ii) Progressive Skill Test:

One mid-term Progressive Skill Test of 25 marks shall be conducted as per criteria given below

Criteria for Continuous Assessment of Practical work and Progressive skill Test:

Domain	**Particulars**	**Marks out of 25**
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Writing skills	05
Affective	Discipline and punctuality and accuracy	05
TOTAL		**25**

Final marks of term work shall be awarded as per *Assessment Pro-forma II.*

b) Criteria for assessment at term end practical exam:

Every student has to perform one practical within 2 hours at term end practical exam which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	10
2	Correct figures / diagrams	10
3	Observation tables	10
4	Result table / calculations / graphs	10
5	Safety / use of proper tools	10
	Total	50

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices
iii) Home Assignments
iv) Discussion

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Item Bank
v) Use of Charts.

10. REFERENCE MATERIAL:

a) Books / IS Codes

Sr. No.	Author	Title	Publisher
1.	Jain & Jain	Engineering chemistry	Dhanpatrai publishing co.
2.	S. C. Rangawala	Engineering materials	Engineering publication
3.	Jain & Agarwal	Metallurgical Analysis	Agarwal publications
4.	O. P. Khanna	Material science & technology	Khanna publication on 2006
5.	Rollason	Metallurgy for Engineers	ASM publication
6.	J. C. Kuriacose	Chemistry in Engineering & Vol. 1 & 11	-
7.	P. C. Jain	Chemistry of Engineering Materials	-
8	S. S. Dara	A text of Engineering Chemistry	
9.	R.Gopalan, D.Venkappa	Engneering Chemistry	Vikas publishing house

b) Websites

i. www.substech.com
ii. www.kentchemistry.com
iii. www.chemcollective.org
iv. www.wqa.org
v. www.chemistryteaching.com

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COURSE ID: ME

Course Name : BASIC MATHEMATICS (CE/ME/EE/MT/IE/ET/IT)
Course Code : CCG105
Course Abbreviation : GBMT

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : < *nil* **>**

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	04
Tutorial	01	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Tutorials	Theory Examination	Practical Examination	
Details of Evaluation	Average of two tests of 20 marks each	As mentioned in the syllabus	Term End Theory Exam (03 hours)	Nil	
Marks	**20**	--	**80**	--	**100**

2. RATIONALE:

Mathematics is an important prerequisite for the development and understanding of engineering and technological concepts. For an engineer and technologist, knowledge of mathematics is an effective tool to pursue and master the applications in the engineering and technological fields. Algebra provides the language and abstract symbols of mathematics. The topics Matrices and Determinants are helpful for finding optimum solution of system of simultaneous equations which are formed in the various branches of engineering using different parameters. Trigonometry is the study of triangles and angles. Contents of this subject will form foundation for further study in mathematics.

3. COMPETENCY:

Apply principles of Basic Mathematics to solve mathematical problems as follows –

1. Cognitive : To understand the mathematical concepts
2. Psychomotor: Proper handling of scientific calculator
3. Affective : Attitude of accuracy, punctuality, proper reasoning and presentation

4. COURSE OUTCOMES (CO'S):

CCG105-1: To solve given problems based on laws of logarithm.
CCG105-2: To solve simultaneous equations using Cramer's rule & find area of triangle.
CCG105-3: To resolve a given function into partial fractions.
CCG105-4: To learn algebra of matrices & hence find Adjoint & Inverse of a given matrix.
CCG105-5: To memorize and solve problems using trigonometric formulae.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic & Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life –long learning	PSO 1 Work in mfg.& service sector	PSO 2 Start entrepreneurial activity
Competency:	3	2	1	3	-	-	3		
CCG105-1	3	2	1	2	-	-	3		
CCG105-2	3	2	1	2	-	-	3		
CCG105-3	3	2	2	2	-	-	3		
CCG105-4	3	2	2	2	-	-	3		
CCG105-5	3	2	2	3	-	1	3		

6. CONTENT:

A) <u>TUTORIALS:</u> Note - Tutorials are to be used to get enough practice

Sr. No	Topics	Tutorial Content (10 problems in each tutorial)
1	Logarithm	Solve simple problems of Logarithms based on definition and laws
2	Determinants	Solve problems on determinant to find area of triangle, and solution of simultaneous equations by Cramer's rule
3	Partial Fractions	To resolve given function into partial fraction using appropriate method.
4	Matrices	Examples on addition, Subtraction and Multiplication of Matrix
5	Matrices	To find Adjoint, Inverse of a given matrix.
6	Trigonometric Ratios and Identities	Examples on conversion of degree to radian and vice versa, simple examples on trigonometry.
7	Allied Angles	Solve examples on Allied angles
8	Compound Angles	Solve examples on Compound angles
9	Factorization & De-factorization angles	Solve examples on Factorization & De-factorization formulae
10	Inverse Trigonometric Ratios	Solve examples on principle value and Inverse trigonometric functions

B) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG105-1: *To solve given problems based on laws of logarithm.*			
1	**Logarithm** 1.1 Concept & laws of logarithm 1.2 Simple examples based on laws of logarithm	**04**	**06**
Course Outcome CCG105-2: *To solve simultaneous equations using Cramer's rule*			
2	**Determinants** 2.1 Definition of nth order determinant 2.2 Expansion of second and third order determinants 2.3 To solve simultaneous equations having 3 unknowns using Cramer's Rule 2.4 Consistency of equations using Determinants	**04**	**06**
Course Outcome CCG105-3: *To resolve a given function into partial fractions*			
3	**Partial Fractions** 3.1 Definition of rational, proper and improper fractions 3.2 Various cases of Partial fractions and Examples	**06**	**12**
Course Outcome CCG105-4: *To learn algebra of matrices & hence find Adjoint & Inverse of a given matrix*			
4	**Matrices** 4.1 Definition of a matrix, Types of matrices 4.2 Algebra of matrices 4.3 Equality of two matrices, Transpose of a matrix 4.4 Minor and Co-factor of an element of a matrix	**10**	**16**
	Total	**24**	**40**

1. Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

2. In each topic, corresponding applications will be explained.

Section II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG105-5: *To memorize and solve problems using trigonometric formulae.*			
5	**Trigonometric Ratios and Identities** 5.1 Fundamental Identities (Simple examples) 5.2 Definition of radian measure 5.3 Conversion of degree into radian and vice versa of standard angles	**02**	**04**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG105-5: *To memorize and solve problems using trigonometric formulae.*			
6	**Trigonometric ratios of Compound and Allied Angles** 6.1 Proofs of sine, cosine and tan of (A+B) and (A-B) 6.2 Examples	**06**	**08**
7	**Trigonometric ratios of Multiple Angles** 7.1 Proofs of sine, cosine and tangent of 2θ, 3θ 7.2 Examples	**05**	**10**
8	**Factorization and Defactorization Formulae** 8.1 Proofs of above formulae 8.2 Examples	**04**	**08**
9	**Inverse Trigonometric Ratios** 9.1 Definition 9.2 Principal value 9.3 Proof of standard formulae	**07**	**10**
	Total	**24**	**40**

1.Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.
2.In each topic corresponding applications will be explained

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No	Name of topic	Distribution of marks (level wise)			Total Marks
		Knowledge	Comprehension	Appli-cation	
1	Logarithm	2	-	4	06
2	Determinants	-	2	4	06
3	Partial Fractions	2	2	8	12
4	Matrices	2	2	12	16
5	Trigonometric Ratios and Identities	2	-	2	04
6	Allied Angles	2	2	4	08
7	Compound Angles	2	-	8	10
8	Factorization & De-factorization angles	2	-	6	08
9	Inverse Trigonometric ratios	2	2	6	10
TOTAL		16	10	54	80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Tutorials

Teaching and Learning resources:

i) Chalk board
ii) Item Bank
iii) MSBTE videos

9. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publisher
1.	G.V. Kumbhojkar	A Textbook on Engineering Mathematics (First Year Diploma)	Phadake Prakashan, Kolhapur
2.	B.S. Grewal	Higher Engginiring Mathematics	Khanna Publication,New Dhelhi
3.	H.K.Das	Higher Engginiring Mathematics	S.Chand Publication,New Dhelhi
4.	Patel, Rawal and others	Basic Mathematics	Nirali Prakashan,Pune
5.	P.M.Patil and Others	Basic Mathematics	Vision Prakashan, Pune
6.	S. S. Shastry	Engineering Mathematics	Prentice Hall of India
7.	Sameer Shaha	Basic Mathematics	Tech Max Publication

b) Website

i) www.khanacademy.org
ii) www.easycalculation.com
iii) www.math-magic.com

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COURSE ID: ME

Course Name : ENGINEERING MATHEMATICS (CE/ME/MT)
Course Code : CCG106
Course Abbreviation : GEMT

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : CCG105

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	04
Tutorial	01	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Tutorials	Theory Examination	Practical Examination	
Details of Evaluation	Average of two tests of 20 marks each	As mentioned in the syllabus	Term End Theory Exam (03 hours)	--	
Marks	**20**	--	**80**	**--**	**100**

2. RATIONALE:

This subject is an extension of Basic mathematics of first semester and a bridge to further study of applied mathematics. The knowledge of mathematics is useful in other technical areas. Differential calculus has applications in different engineering branches. For example concepts such as bending moment, curvature, maxima and minima. Numerical methods are used in programming as an essential part of computer engineering. In Metrology and quality control statistical methods are used to determine the quality and suitability of components. Engineering mathematics lays the foundation to understand technical principles in various fields.

3. COMPETENCY:

Apply principles of Engineering Mathematics to solve Engineering problems as follows-

i. Cognitive : Understanding and applying principles of Engineering Mathematics to Engineering problems

ii. Psychomotor: a) Use of co-ordinate geometry in animation, AutoCAD, computer graphics etc.
b) Proper handling of calculator.

iii. Affective : Attitude of accuracy, punctuality, presentation, visualization.

4.COURSE OUTCOMES (CO'S):

CCG106 - 1: To understand and solve examples of complex numbers.
CCG106 - 2: To solve problems on two-dimensional co-ordinate geometry for straight line.
CCG106 - 3: To solve problems on Probability using addition theorem.
CCG106 - 4: Utilize basic concepts of probability distribution to solve elementary engineering Problems.
CCG106 - 5: To find limits of different types of functions using various methods.
CCG106 - 6: To solve the problems of maxima, minima and geometrical applications.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	PO 1 Basic & Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life –long learning	PSO 1 Work in mfg.& service sector	PSO 2 Start entrepreneurial activity
Competency	3	2	2	2	1	-	3		
CCG106-1	3	2	2	2	1	-	3		
CCG106-2	3	2	2	2	1	-	3		
CCG106-3	3	2	2	2	3	-	3		
CCG106-4	3	2	2	2	3	-	3		
CCG106-5	3	2	2	2	1	-	3		
CCG106-6	3	2	2	2	3	-	3		

6. CONTENT:

A) TUTORIALS: Note - Tutorials are to be used to get enough practice

Sr No.	Topic	Tutorial Content (10 problems in each tutorial)
1	Complex Number	Solve problems based on algebra of complex numbers & De- moivre's theorem
2	Straight line	Examples on different cases of straight line, to find perpendicular distance of a point from a line, angle between two lines, intersection of lines.
3	Probability	Examples on Addition theorem & Solve problems based on Binomial distribution
4	Probability Distribution	Solve problems based on Poisson distribution
5	Probability Distribution	Solve problems based on Normal distribution
6	Functions	Examples on value of functions, Odd & Even functions, Composite functions
7	Limits	Evaluation of limits by Factorization, Rationalization, Simplification, Infinity method
8	Differentiation	To find derivatives by product rule, quotient rule, Chain rule, Inverse function, Implicit function
9	Differentiation	To find derivatives of Parametric function, Logarithmic function, Derivatives of second order
10	Applications of Derivatives.	To find equation of Tangent, Normal & To find Maxima and Minima of a function.

B) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course outcome CCG106-1: *To understand and solve examples of complex numbers.*			
1	**Complex Number** 1.1 Definition, Algebra of complex numbers, simple examples 1.2 Polar form, Exponential form 1.3 De- Moivre's theorem	**04**	**10**
Course outcome CCG106-2: *To solve problems on two-dimensional co-ordinate geometry for straight line.*			
2	**The Straight line** 2.1 Slope, intercepts & various methods of finding slope 2.2 Conditions for two straight lines to be parallel and Perpendicular to each other 2.3 Various forms of equations of straight line 2.4 Perpendicular distance of a point from a line 2.5 Distance between two parallel lines 2.6 Angle between two straight lines 2.7 Intersection of two straight lines	**06**	**10**
Course outcome CCG106-3: *To solve problems on Probability using addition theorem.*			
3	**Probability** 3.1 Mathematical definition of Probability of any event 3.2 Addition theorem of Probability 3.3 Examples	**04**	**06**
Course outcome CCG106-4: *Utilize basic concepts of probability distribution to solve elementary engineering Problems.*			
4	**Probability Distribution** 4.1 Binomial distribution. 4.2 Poisson's distribution. 4.3 Normal distribution.	**10**	**14**
	Total	**24**	**40**

Section II			
Sr. No	**Topics / Sub-topics**	**Lectures (Hours)**	**Theory Evaluation (Marks)**
Course outcome CCG106-5: *To find limits of different types of functions using various methods.*			
5	**Functions** 5.1 Definition and Concept of function 5.2 Definition of Odd & Even functions, Explicit & implicit functions, Composite functions, Parametric functions 5.3 Value of a function Examples on value of functions, Odd & Even functions Composite functions	**04**	**06**
6	**Limits** 6.1 Definition 6.2 Limits of algebraic functions by factorization, simplification, rationalization, Limit as $x \to \infty$	**05**	**08**
Course outcome CCG106-6: *To solve the problems of maxima, minima and geometrical applications.*			
7	**Differentiation** 7.1 Definition, Derivative of standard functions (without poof), 7.2 Derivative of sum, difference, product and quotient of two or more functions 7.3 Derivative of composite functions 7.4 Derivative of Inverse functions 7.5 Derivative of Implicit functions 7.6 Derivative of Parametric functions 7.7 Derivative of exponential and logarithmic functions 7.8 Logarithmic differentiation 7.9 Differentiation of second order	**12**	**20**
8	**Applications Of Derivatives** 8.1 Geometrical meaning of derivative (To find equation of Tangent and normal) 8.2 Maxima and minima of functions	**03**	**06**
	Total	**24**	**40**

1.Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

2. In each topic corresponding applications will be explained

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Topic No.	Name of topic	Distribution of marks (level wise)			Total Marks
		Knowledge	Comprehension	Application	
1	Complex Number	4	2	4	10
2	Straight line	2	2	6	10
3	Probability	2	-	4	6
4	Probability Distribution	4	2	8	14
5	Functions	2	-	4	6
6	Limits	2	2	4	8
7	Differentiation	4	4	12	20
8	Applications Of Derivatives	--	--	6	6
Total		20	12	48	80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Tutorials

Teaching and Learning resources:

i) Chalk board
ii) Item Bank
iii) MSBTE videos

9. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publisher
1.	G.V. Kumbhojkar	Engineering Mathematics III	Phadake Prakashan, Kolhapur
2.	B.S. Grewal	Higher Engineering Mathematics	Khanna Publication, New Dhelhi
3.	H.K.Das	Higher Engineering Mathematics	S.Chand Publication,New Dhelhi
4.	Patel, Rawal and others	Engineering Mathematics	Nirali Prakashan, Pune
5.	Mathematics for Polytechnic	S. P. Deshpande	Pune Vidyarthi Griha Prakashan
6.	Sameer Shaha	Engineering Mathematics	Tech-Max Publication, Pune
7.	A.M. Vaidya	Applied Mathematics	Central Techno
8.	P.M.Patil and Others	Engineering Mathematics	Vision Prakashan, Pune

b) Websites:

i) www.khanacademy.org
ii) www.easycalculation.com
iii) www.math-magic.com

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COURSE ID: ME

Course Name : ENGINEERING DRAWING -1 (CE/ME/MT)
Course Code : CCG107
Course Abbreviation: GEDA

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s): Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	Term end practical exam	
Marks	**20**	As per Proforma-II	**80**	**25 I**	**125**

I- Internal Assessment

2. RATIONALE:

Engineering drawing is the language of engineers. The concept of engineering drawing is used to develop, express the ideas, and convey the instructions which are used to carry out jobs in the field of Engineering. The course illustrates the techniques of drawing in actual practice. This Preliminary course aims at building a foundation for the further course in drawing and other allied subjects. This subject is useful in developing, drafting and sketching skills of students.

3. COMPETENCY:

Use various drawing Instruments for drafting and sketching solid geometry

a) Cognitive : Understand various drawing procedures.
b) Psychomotor: Draw engineering curves & projections of lines, planes & solids
c) Affective : Attitude of using i) Procedures ii) Practices iii) Drawing Instruments iv) Accuracy v) Drafting Skill

4. COURSE OUTCOMES:

CCG107-1 Understand various fundamentals in engineering drawing.
CCG107-2 Produce different types of engineering curves.
CCG107-3 Produce the projection of point & lines inclined to one reference plane.
CCG107-4 Produce the projection of different planes**.**
CCG107-5 Produce orthographic drawing and sectional orthographic drawing from given pictorial view.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO)

MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme outcome POs and PSO's								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & testing	PO 5 Engineer ing Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
CCG107-1	3	-	-	-	-	-	-	-	-
CCG107-2	3	-	1	-	-	-	-	-	-
CCG107-3	3	-	-	1	1	-	-	-	-
CCG107-4	3	-	1	-	-	-	-	-	-
CCG107-5	3	-	1	1	-	-	-	-	-

6. CONTENT

A. LAB AND PRACTICAL WORK:

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work as detailed in practical sessions of batches of about 22 students

Sr. no	Laboratory experience	Skills developed	Course Outcome
1	Lines and Lettering (1 Sheet)	To develop drawing skill	CCG107-1
2	Engineering curves (1 Sheet)	To develop drawing ability in conics	CCG107-2
3	Projections of line (1 Sheet)	To develop drawing ability in Projections of line	CCG107-3
4	Projections of Planes (1 Sheet)	To develop drawing ability in Projections of Planes	CCG107-4
5	Orthographic projection (1 Sheet)	To develop drawing ability to draw different views of object.	CCG107-5
6	Sectional Orthographic projection (1 Sheet)	To develop drawing ability to draw Sectional views of object.	CCG107-5

B) THEORY

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **CCG107-1** *Understand various fundamentals in engineering drawing*			
1.	**INTRODUCTION TO ENGINEERING DRAWING** 1.1 Drawing Instruments and their uses 1.2 Standard sizes of drawing sheets (ISO-A series) 1.3 Letters and numbers (single stroke vertical) Convention of lines and their applications. 1.4 Scale (reduced, enlarged & full size) Plain scale and Diagonal scale. 1.5 Dimensioning technique as per SP-46 (Latest Edition) Types and applications of chain, parallel and Co-ordinate dimensioning	**06**	**08**
Course Outcome **CCG107-2** *Produce different types of engineering curves*			
2.	**ENGINEERING CURVES** 2.1 Conic curves and their applications 2.2 Ellipse by Arc's of circle method & Concentric circles method. 2.3 Parabola by Directrix and focus method & Rectangle method 2.4 Hyperbola by Transverse Axis focus Method & Rectangular hyperbola (Inclined axes). 2.5 Involutes of circle, & pentagon, hexagon 2.6 cycloid, epicycloids, hypocycloid 2.7 Helix & Archimedean spiral.	**12**	**20**
Course Outcome **CCG107-3** *Produce the projection of point & lines inclined to one reference plane*			
3.	**PROJECTION OF POINT AND LINES** 3.1 Projection of points when point is in first quadrant Only 3.2 Projection of Line inclined to one Reference plane and Parallel to other Reference Plane (Both ends of line should be in first quadrant)	**06**	**12**

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome **CCG107-4** *Produce the projection of different planes.*			
4.	**PROJECTION OF PLANES** 4.1 Projection of Planes - Circular, Square, Triangular, Rectangular, Pentagonal, Hexagonal Shapes Inclined to One Reference Plane And perpendicular to another Reference Plane. (Planes in First Quadrant Only)	**06**	**12**

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
***Course Outcome* CCG107-5** *Produce orthographic drawing and sectional orthographic drawing from given pictorial view.*			
5.	**ORTHOGRAPHIC PROJECTION** 5.1 Introduction of Orthographic Projection -First and Third angle Projection Method 5.2 Conversion of Pictorial view into Orthographic Views. (First angle Projection Method Only) 5.3 Dimensioning Technique as per SP-46	**08**	**14**
Course Outcome CCG107-5 *Produce orthographic drawing and sectional orthographic drawing from given pictorial view*			
6.	**SECTIONAL VIEWS** 6.1 Types of sections 6.2 Conversion of pictorial view into sectional Orthographic views. (First Angle Projection Method only)	**08**	**14**
***Course Outcome* CCG107-1** *Understand various fundamentals in engineering drawing*			
7.	**AUTOCAD** 7.1 Introduction to CAD software (Basic commands like Draw, modify), Advantages of CAD 7.2 Geometrical Constructions 7.3 Draw a basic 2-D geometrical entities using CAD	**02**	**NIL**
	Total	**48**	**80**
1. Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only. 2. No theory question on chapter no.7			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Appli-cation		
1	Introduction To Engineering Drawing	04	02	02	CCG107-1	08
2	Engineering curves	04	04	12	CCG107-2	20
3	Projection of Point and Lines	04	04	04	CCG107-3	12
4	Projection of Planes	04	06	02	CCG107-4	12
5	Orthographic Projection	04	08	02	CCG107-5	14
6	Sectional Views.	04	08	02	CCG107-5	14
	Total	24	32	24		80

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL WORK

a) Assessment Criteria for Lab work:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per given criteria.

Sr No.	Criteria	Marks allotted
1	Attendance	05
2	Preparedness	05
3	Correctness and understanding	10
4	Line work and neatness	05
	Total	25

ii) Progressive Skill Test:

One mid-term ***Progressive Skill*** *Test* of **25**marks shall be conducted as per criteria given below:

Sr No	Criteria	Marks allotted
1	Correctness and understanding	10
2	Line work and neatness	05
3	Dimensioning and judgment without measurement	05
4	Proper use of instrument	05
	Total	25

b) Criteria for assessment at Term End Practical exam:

Every student has to perform term end practical exam which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	05
2	Correct drawing	05
3	Proper use of instrument	05
4	Line work and neatness	05
5	Dimensioning and judgment without measurement	05
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

1. Lectures cum Demonstrations
2. Classroom practices

Teaching and Learning resources:

1. Chalk board
2. LCD presentations
3. Audio presentations
4. Computer, printer etc.
5. Question Bank

10. REFERENCE MATERIAL:

a) Reference Books:

Sr. No.	Author	Title	Publisher
1.	N. D. Bhatt	Engineering Drawing	Charotar Publishing House 2010
2.	Amar Pathak	Engineering Drawing	Dreamtech Press, 2010
3.	D. Jolhe	Engineering Drawing	Tata McGraw Hill Edu., 2010
4.	M.B.Shah, B.C.Rana	Engineering Drawing	Pearson, 2010
5.	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age Publication, Reprint 2006
6.	IS Code, SP – 46	Engineering Drawing Practice	--

b) Web References:

i) http://www.design-technology.info/IndProd/drawings/
ii) http://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/
iii) http://en.wikipedia.org/wiki/Engineering_drawing
iv) http://www.engineeringdrawing.org/
v) http://www.teachengineering.org/view_activity
vi) www.howtoread.co.in/2013/06/how-to-read-ed.html
vii) http://www.slideshare.net/akhilrocker143/edp
viii) http://www.24framesdigital.com/pstulpule

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COURSE ID: ME

Course Name : ENGINEERING DRAWING - II (CE/ME/MT)
Course Code : CCG108
Course Abbreviation : GEDB

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s): CCG107

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	Term end practical exam	
Marks	**20**	As per Proforma-II	**80**	**25 I**	**125**

I- Internal Examination

2. RATIONALE:

Engineering drawing is the graphical language of engineers. It describes the scientific facts, Concepts, principles and techniques of drawing in any engineering field to express the ideas, conveying the instructions, which are used to carry out jobs in engineering field. This course aim for building a foundation for the further course in drawing and other allied subjects

3. COMPETENCY:

Read, draw &interpret the engineering drawing of simple objects.

a) Cognitive : Understand &visualize the given component drawing.
b) Psychomotor: Produce engineering drawing from the given problem
c) Affective : Attitude of using i) Procedures ii) Practices iii) Drawing instruments iv) Techniques v) Drafting skill

4. COURSE OUTCOMES:

CCG108-1 Produce the projection of different solids.
CCG108-2 Produce sectional views of different types of solids.
CCG108-3 Draw proportionate free hand sketches.
CCG108-4 Interpret the views & complete the missing view.
CCG108-5 Visualize & draw accordingly the pictorial view by correlating the given views.
CCG108-6 Construct development of lateral surfaces.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme outcome POs and PSO's								
	Po 1 Basic and discipline specific knowledge	**Po 2 problem analysis**	**Po3 Design/development of solutions**	**Po 4 engineering tools, experimentation & testing**	**Po 5 Engineer ing practices for society, sustainability and environment**	**Po 6 project management**	**Po 7 Life-long learning**	**Pso 1 Work in mfg& service sector**	**Pso 2 Start entrepreneurial activity**
Competency					-				
CCG108-1	3						1		
CCG108-2	3						1		
CCG108-3	3		1	1	1		1	2	
CCG108-4	3						1		
CCG108-5	3		1				1	2	
CCG108-6	3		1		1		1	2	1

6. LAB OR PRACTICAL WORK

A) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work as detailed in practical sessions of batches of about 22 students:

Sr. no	Laboratory experience	Skills developed	Course Outcome
1	Projection Of Solids (1 Sheet)	To develop drawing ability in projection of solids.	CCG108-1
2	Sections of Solids (1 Sheet)	To develop drawing ability in section of solids.	CCG108-1
3	Free Hand Sketches (1 Sheet)	To develop ability to draw free hand sketches of machine components, screw thread profile, riveted and welded joints	CCG108-3
4	Missing Views (1 Sheet)	To develop ability to draw Missing views and convert given view into sectional view.	CCG108-4
5	Isometric Projection (1 Sheet)	To develop ability to draw Isometric projection	CCG108-5
6	Development of Surfaces (1 Sheet)	To develop drawing ability in Development of surfaces of cone, prism, pyramid and cylinder	CCG108-6

B. CONTENT:

THEORY:

SECTION - I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
***Course Outcome* CCG108-1** *Produce the projection of different solids.*			
1.	**Projection Of Solids** 1.1 Projection of Solids Like Cube, Prisms, Pyramids, Cone, Cylinders and Tetrahedron. (Axis of Solids inclined to one reference plane and Parallel to another Reference Plane)	**10**	**16**
***Course Outcome* CCG108-2** *Produce sectional views of different types of solids*			
2.	**Sections of Solids** 2.1 Sections of Solids Like Cube, Prisms, Pyramids, Cone and Cylinders. (Axis of Solids being vertical and Section plane inclined to one reference plane and perpendicular to other Reference Plane	**10**	**16**
***Course Outcome* CCG108-3** *Draw proportionate free hand sketches.*			
3.	**Free Hand Sketches** 3.1 Profiles of Screw Threads (V and Square Thread) Conventional representation of threads. 3.2 Free hand sketches of nuts and bolts, Washer, Locking arrangement of nuts, Foundation bolts 3.3 Riveted and Welded Joints.	**04**	**08**

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
***Course Outcome* CCG108-4** *Interpret the views & complete the missing view.*			
4.	**Missing Views.** 4.1 Interpretation of the given two orthographic views and draw missing view from the given two Orthographic views and convert one of the given views into sectional Orthographic views. (First Angle Projection Method only)	**06**	**08**
***Course Outcome* CCG108-5** *Visualize & draw accordingly the pictorial view by correlating the given views.*			
5.	**Isometric Projection** 5.1 Introduction 5.2 Isometric Axis 5.3 Isometric scale 5.4 Isometric view and Isometric Projection 5.5 Conversion of Orthographic Views into Isometric View/Projection (Including rectangular, cylindrical objects, representation of slots on sloping as well as plane surfaces)	**10**	**16**

***Course Outcome* CCG108-6** *Construct development of lateral surfaces.*			
6.	**Developments of Surfaces** 6.1 Methods of Development 6.2 Developments of Lateral surfaces of right solids Prism, Cylinders, Pyramid and Cone.	**08**	**16**
	Total	**48**	**80**
1.Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level wise)			Course Outcome	Total Marks
		Remember	Understand	Applica-tion		
1	Projection Of Solids	06	06	04	CCG108-1	16
2	Sections of Solids	06	06	04	CCG108-2	16
3	Free Hand Sketches	04	02	02	CCG108-3	08
4	Missing Views	02	04	02	CCG108-4	08
5	Isometric Projection	04	04	08	CCG108-5	16
6	Developments of Surfaces	04	08	04	CCG108-6	16
	Total	26	30	24		80

8. CRITERIA FOR CONTINUOUS ASSESSMENT OF PRACTICAL WORK AND PROGRESSIVE SKILL TEST:

a) Assessment Criteria for Lab work:

i) Continuous Assessment of Drawing Practical

Every practical Sheet shall be assessed for **25** marks as per criteria given below:

Sr No.	Criteria	Marks allotted
1	Attendance	05
2	Preparedness	05
3	Correctness and understanding	10
4	Line work and neatness	05
	Total	25

ii) Progressive Skill Test:

One mid-term ***Progressive Skill*** *Test* of **25**marks shall be conducted as per criteria given below:

Sr No.	Criteria	Marks allotted
1	Correctness and understanding	10
2	Line work and neatness	05
3	Dimensioning and judgment without measurement	05
4	Proper use of instrument	05
	Total	25

b) Criteria for assessment at Term End Practical Exam:

Every student has to perform term end practical exam which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	05
2	Correct drawing	05
3	Proper use of instrument	05
4	Line work and neatness	05
5	Dimensioning and judgment without measurement	05
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Computer, printer etc.
v) Question Bank

10. REFERENCE MATERIAL:

a) Reference Books:

Sr. No.	Author	Title	Publisher
1.	N. D. Bhatt	Engineering Drawing	Charotar Publishing House 2010
2.	Amar Pathak	Engineering Drawing	Dreamtech Press, 2010
3.	D.Jolhe	Engineering Drawing	Tata McGraw Hill Edu., 2010
4.	M.B.Shah, B.C.Rana	Engineering Drawing	Pearson, 2010
5.	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age Publication, Reprint 2006
6.	IS Code, SP – 46	Engineering Drawing Practice	--

b) Web References:

1) http://www.design-technology.info/IndProd/drawings/
2) http://graphicalcommunication.skola.edu.mt/syllabus/engineering-drawing/
3) http://en.wikipedia.org/wiki/Engineering_drawing
4) http://www.engineeringdrawing.org/
5) http://www.teachengineering.org/view_activity
6) www.howtoread.co.in/2013/06/how-to-read-ed.html
7) http://www.slideshare.net/akhilrocker143/edp
8) http://www.24framesdigital.com/pstulpule

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COURSE ID: ME

Course Name : APPLIED MECHANICS (CE/ME/EE/MT)
Course Code : CCG110
Course Abbreviation : GAPM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PR End Exam of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-II	
Marks	**20**	**--**	**80**	**25 I**	**125**

I – Internal Assessment

2. RATIONALE:

Applied mechanics mainly deals with engineering problems regarding equilibrium and motion of material bodies under the action of mechanical and gravitational forces. As most branches of engineering come across situations involving bodies subjected to mechanical and gravitational forces, this course becomes one of the basic courses in engineering.

3. COMPETENCY

Apply principles of applied mechanics to solve engineering problems as follows:

a) Cognitive : Understanding and applying principles of mechanics to engineering problems
b) Psychomotor: i) Operating simple lifting machines ii) drawing graphic constructions
c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality v) aesthetic presentation

4. COURSE OUTCOMES:

CCG110-1 Determine resultant of coplanar force systems
CCG110-2 Solve problems on bodies in equilibrium with and without friction
CCG110-3 Solve problems on statics graphically
CCG110-4 Solve problems on centre of gravity of laminas and solids
CCG110-5 Solve problems on motion using kinematic and kinetic equations
CCG110-6 Solve problems on simple lifting machines

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme outcome POs and PSO's								
	Po 1 Basic and discipline specific knowledge	**Po 2 problem analysis**	**Po3 Design/development of solutions**	**Po 4 engineering tools, experimentation & testing**	**Po 5 Engineer ing practices for society, sustainability and environment**	**Po 6 project management**	**Po 7 Life-long learning**	**Pso 1 Work in mfg& service sector**	**Pso 2 Start entrepreneurial activity**
Competency					-				
CCG108-1	3	1	1	2	-	-	2	-	-
CCG108-2	3	1	1	2	-	-	2	-	--
CCG108-3	2	1	1	-	-	-	1	-	-
CCG108-4	3	1	1	1	-	-	2	-	-
CCG108-5	3	1	1	-	-	-	2	-	--
CCG108-6	2	1	1	2	-	-	1	-	-

6. PRACTICAL WORK

A) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Practical Work as detailed in the *Laboratoty Manual for Applied Mechanics* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Collection and presentation of four photos/graphics/ videos on field applications of mechanics	1. Information collection and presentation 2. Motivation through field exposure	CCG110-1 to CCG110-6
2-7	**Experiments on equilibrium of bodies:** (*any six*) 1. Verification of law of polygon of forces 2. Verification of law of parallelogram of forces 3. Verification of Varignon's theorem of moments for non-concurrent force system 4. Verification of Lami's theorem 5. Determination of reactions of beam 6. Determination of coefficient of friction and verification of laws of friction 7. Determination of centroid and centre of gravity	1. Self-learning ability using laboratory manual 2. Measuring dimensions and angles 3. Applying concepts studied 4. Plotting and interpreting graphs 5. Drawing real view diagrams of machine 6. Time management and team working skills 7. Presentation skills	CCG110-2 CCG110-4

8-11	**Experiments on simple lifting machines:** (*any four*) 1. Study of differential axle and wheel 2. Study of simple screw jack 3. Study of worm and worm wheel 4. Study of single gear crab 5. Study of double gear crab 6. Study of Weston's differential pulley block 7. Study of two sheaves and three sheaves pulley block 8. Study of worm geared pulley block	1. Studying mechanism of machine 2. Deriving expression for velocity ratio of machine 3. Measuring dimensions of machine parts using thread, etc. 4. Taking readings of loads and efforts 5. Plotting and interpreting graphs 6. Drawing real view diagrams of machine 7. Time management, team working and presentation skills	CCG110-6
12	**Graphic Statics: One** problem each 1. To determine resultant concurrent force system 2. To determine resultant parallel force system 3. To determine resultant non-current non-parallel force system 4. To determine Equilibrium force of any one force system	1. Planning paper space 2. Choice of proper scale 3. Drawing and presentation skills 4. Applying concepts studied	CCG110-3
13	**Graphic Statics:** Four problems to determine Reactions of beam		CCG110-3
14	Pictorial Question Quiz		CCG110-1 CCG110-2 CCG110-4 CCG110-5 CCG110-6

B) Industrial Exposure:

(Included in *Laboratory Manual for Applied Mechanics*)

SN	Mode of Exposure	Topic
1.	Field examples of course application	Every chapter of theory syllabus
2.	Field examples of course application	Practical -work assignment

C. CONTENT

Section-I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG110-1 Determine resultant of coplanar force systems			
1	**Resolution and Composition of Forces** 1.1 Definition and meaning of the terms mechanics, applied mechanics, particle, rigid body, mass, force, weight 1.2 Attributes of a force: Magnitude, direction, sense and position. Principle of transmissibility. Graphical representation of force 1.3 Force systems: Definition and types of force systems like coplanar and non–coplanar. Types of coplanar force systems like concurrent, non-concurrent, parallel, non-parallel. Field examples of various force systems 1.4 Moment of a force about a point 1.5 Couple: properties of couple. Field examples of moments and couples 1.6 Resolution of a force into two orthogonal and oblique components 1.7 Composition of forces: Definition and meaning of resultant of a force system. Law of parallelogram of forces. Varignon's theorem. Determination of resultant of coplanar force systems by analytical method	**08**	**12**
Course Outcome CCG110-2 Solve problems on bodies in equilibrium with and without friction			
2.	**Equilibrium of Bodies** 2.1 Definition of equilibrium of a body and equilibrant. Conditions of equilibrium. Law of moments. 2.2 Supports: Definition, types and reactions. Free-body diagrams of bodies. Field examples. 2.3 Lami's theorem. Field examples. 2.4 Beams: Definition, types and field examples. Types and field examples of loads. Problems on support reactions of statically determinate beams carrying concentrated loads, uniformly distributed loads and concentrated moments (analytical method) 2.5 Statically determinate problems on bodies in equilibrium (analytical method)	**08**	**12**
3	**Friction** 3.1 Definition of friction. Static and dynamic friction. Laws of friction. Coefficient of friction. Angle of repose, Angle of friction. Field examples. 3.2 Problems involving bodies on horizontal and inclined rough surfaces and ladders	**04**	**10**
Course Outcome CCG110-3 Solve problems on statics graphically			

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome CCG110-1 Determine resultant of coplanar force systems			
4	**Graphic Statics** 4.1 Advantages and limitations of graphical methods. Bow's notation. Space diagram, vector diagram 4.2 Parallelogram, triangle and polygon laws of forces 4.3 Problems on resultant of concurrent force systems 4.4 Funicular polygon. Problems on resultant of non-current force systems 4.5 Problems on reactions of statically determinate beams with simple and hinged supports carrying concentrated loads	**04**	**06**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section- II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
CCG110-4 Solve problems on centre of gravity of laminas and solids			
5	**Centroid and Centre of Gravity** 5.1 Definition and field applications of centroid and centre of gravity 5.2 Centroid of standard line figures. Problems involving composite figures made up of standard line figures 5.3 Centroid of standard laminas. Problems involving composite laminas made up of standard laminas 5.4 Centre of gravity of standard solids. Problems involving simple composite solids made up of standard solids	**08**	**12**
Course Outcome CCG110-5 Solve problems on motion using kinematic and kinetic equations Rectilinear Motion & Angular Motion			
6	**Rectilinear Motion** 6.1 Definition of motion, dynamics, kinematics, kinetics, displacement, speed, velocity, acceleration, motion under gravity. Simple problems with uniform acceleration. Field examples 6.2 Newton's laws of motion. Simple problems 6.3 Definition of momentum. Law of conservation of momentum. Simple problems **Angular Motion** 6.4 Definition of angular motion, angular displacement, angular velocity, angular acceleration, torque, Field examples	**03** **03**	**06** **06**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	6.5 Kinematic and kinetic equations of angular motion. Simple problems with uniform angular acceleration		
7	**Work, Power, Energy** 7.1 Definition of work done by a force. Work done by torque 7.2 Definition of energy. Forms of energy. Law of conservation of energy. Field examples 7.3 Definition of power 7.4 Simple problems on work, power and energy	**04**	**06**
Course Outcome CCG110-6 Solve problems on simple lifting machines			
8	**Simple Lifting Machines** 8.1 Definition of simple lifting machine, load, effort, mechanical advantage, velocity ratio, efficiency at a load. Field examples 8.2 Law of machine, maximum mechanical advantage, maximum efficiency, reversibility or non-reversibility of a machine at a load 8.3 Friction in machine, ideal machine, effort lost in friction, ideal effort, ideal load 8.4 Problems on simple lifting machines. (Problems or questions on any particular machines are not expected; they shall be covered in practicals)	**06**	**10**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Resolution and Composition of Forces	02	02	08	CCG110-1	**12**
2	Equilibrium of bodies	02	04	06	CCG110-2	**12**
3	Friction	02	02	06	CCG110-2	**10**
4	Graphics Statics	-	02	04	CCG110-3	**06**
5	Centroid and Centre of Gravity	-	04	08	CCG110-4	**12**
6	Rectilinear Motion	02	02	02	CCG110-5	**06**
7	Angular Motion	02	02	02	CCG110-5	**06**
8	Work, Power, Energy	02	-	04	CCG110-5	**06**

9	Simple Lifting Machines	02	02	06	CCG110-6	**10**
TOTAL		**14**	**20**	**46**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR PRACTICAL WORK AND PRACTICAL EXAMINATION

a) Assessment Criteria for practical work:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 50 marks as per following criteria:

Domain	**Particulars**	**Marks out of 25**
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality Decency and presentation	05
TOTAL		25

ii) Criteria for Progressive skill Test:

One mid-term Progressive Skill Test of 25 marks shall be conducted as per criteria given below

Sr. no	**Criteria**	**Marks allotted**
1	Preparedness for practical	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result table / calculations / graphs	5
5	Safety / use of proper tools	5
	Total	25

b) Term End Practical Exam:

One end-term *Practical Exam* of 25 marks shall be conducted.

Final marks of practical shall be awarded as per *Assessment Pro-forma-II*

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result table / calculations / graphs	5
5	Safety / use of proper tools	5
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Question Bank

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	Dixit, Nehate, Shaikh	Text Book on Applied Mechanics	Vision
2.	Sunil Deo	Text book on Engineering Mechanics	Nirali
3.	Bhavikatti and Rajashekharappa	Engineering Mechanics	Peerson
4.	Mariam & Mariam	Engineering Mechanics	John Wiley & Sons Inc
5.	Beer & Johnston	Vector Mechanics: Statics and Dynamics	McGraw Hill Inc

b) Websites

i) *http://en.wikipedia.org/wiki/Applied_mechanics*
ii) www.nptel.ac.in

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COURSE ID: ME

Course Name : WORKSHOP PRACTICES – 1 (ME/MT)
Course Code : CCG112
Course Abbreviation : GWSB

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	00	02
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PR End Exam of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-II	
Marks	**--**	As per Proforma-II	**--**	**50 I**	**50**

I – Internal Assessment

2. RATIONALE:

Workshop practices- I mainly deals with Fitting, Plumbing and Wood working. A technician has to work in such environment with his peers, superiors and subordinates for a major part of his life. Therefore, the emphasis on the practical work is needed for the primary experience of working in the team.

3. COMPETENCY:

Prepare a simple job using wood working, plumbing and welding technique.

a) Cognitive : Understand various trade practices in engineering.
b) Psychomotor: Use of various tools in Fitting, Wood working, Plumbing shop.
c) Affective : Develop **a**ttitude of i) Interpret drawing ii) Safety

4. COURSE OUTCOMES:

CCG 112-1: Select different types of wood material.
CCG 112-2: Select different types of tools used in workshop.
CCG 112-3: Preparing simple components in workshop.
CCG 112-4: Interpret drawing.
CCG 112-5: Practicing safety in workshop.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design /development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering practices for society, sustainability and environment**	**PO 6 Project Management**	**PO 7 Life-long learning**	**PSO 1 Work in mfg& service sector**	**PSO 2 Start entrepreneurial activity**
Competency	1	-	-	3	-	-	-	2	-
CCG112-1	1	-	-	3	-	-	-	2	-
CCG 112-2	1	-	-	3	-	-	-	2	-
CCG 112-3	1	-	-	3	-	-	-	2	-
CCG 112-4	1	-	-	3	-	-	-	2	-
CCG 112-5	1	-	-	3	-	-	-	2	-

6. PRACTICAL WORK:

Sr. No.	Topics/ Sub-Topics	Skills/ Competencies to be developed	Practical (Hours)/ Evaluation (Marks)
Course outcome: CCG 2 to CCG 5			
1	**Fitting Shop**: a) Demonstration of different fitting tools, drilling and power tools. b) Demonstration of different operations like marking, filing, cutting, drilling, tapping etc. c) One simple fitting job (Male Female assembly type involving practice of filing, drilling, cutting, tapping etc.	a) Study of fitting tools, identifying materials b) Measuring dimensions c) Interpretation of drawing d) Selection of tools e) Time management and observing safety habits f) Operate drilling m/c, saw m/c	10/16
Course outcome: CCG 2 to CCG 5			
2	**Plumbing shop: -** a) Demonstration of tools. b) One job on simple pipe joint with nipple coupling for Standard pipe, Pipe threading using standard die set (One job per one group of 04 students). c) Demonstration of PVC pipe joint with various PVC fittings& accessories.	a) Study of plumbing tools, identifying materials b) Interpretation of drawing c) Threading with dies on pipe d) Time management and observing safety habits e) Selection of pipe joint &fittings.	10/16

Sr. No.	Topics/ Sub-Topics	Skills/ Competencies to be developed	Practical (Hours)/ Evaluation (Marks)
Course outcome: CCG 1 to CCG 5			
3	**Wood Working shop: -** a) Demonstration of different wood working tools &machines b) Identify, select & use various Marking, Measuring, Cutting, Holding & Striking tools & equipments. c) Operate different machines & equipments in respective shop. d) Know basic workshop processes. e) Demonstration of different wood working processes like Planning, Marking, Chiseling, Grooving, Turning of wood etc. f) One simple job based on the above processes for 04 to 06 students group. Measure dimensions	a) Study of wood working tools, Identifying materials b) Measuring dimensions c) Interpretation of drawing d) Operating planning, cutting, drilling machines. e) Time management and observing safety habits f) Prepare furniture or article with carpentry joints	12/18

The students will submit the following.

Workshop record book showing the details of the job viz. Drawing, Raw material size, time required completing the job. The journal consisting of the neat sketches, specifications use of the hand tool, and hand operations based on the demonstration in all the trades during the practical work.

7. ASSESSMENT CRITERIA FOR PRACTICAL AND PRACTICAL EXAMINATION

a) Assessment Criteria for Practical:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 50
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
	Decency and presentation	10
TOTAL		**50**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Final marks of term work shall be awarded as per *Assessment Pro-forma II.*

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality Decency and presentation	05
TOTAL		**25**

b) Criteria for assessment at term end practical exam:

Every student has to perform one practical within 2 hours at term end practical exam which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	10
2	Correct figures / diagrams	10
3	Skill (Finishing in dimensions)	20
4	Safety / use of proper tools	10
	Total	50

8. INSTRUCTIONAL STRATEGIES: -

Instructional Method

i) Demonstration during Practicals.

ii) Workshop Record Book

Teaching and learning resources: -

i) Shop Demonstration

ii) Hands on training on machine

9. Reference:

a) **books**

Author	Title	Publisher
S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat Rai & Co.

b) Websites:

i) http://nptel.ac.in

ii) www.egr.msu.edu/~pkwon/me478

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COURSE ID: ME

Course Name : WORKSHOP PRACTICES – 2 (ME/MT)
Course Code : CCG116
Course Abbreviation : GWSF

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : CCG112

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	00	02
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PR End Exam of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-II	
Marks	**--**	As per Proforma-II	**--**	**50 I**	**50**

I – Internal Assessment

2. RATIONALE:

The workshop practices -2 mainly deals with Wood working, Sheet metal, Welding and Smithy work are commonly used in Engineering Industry. A technician has to work in such environment with his peers, superiors and subordinates for a major part of his life. Therefore, the emphasis on the practical work is needed for the primary experience of working in the team.

Such working upgrades the mental and manual abilities / skills of using efficiently the basic tools in most of the industries. The students are required to supervise, maintain equipments, where he needs the knowledge of basic workshop skills such as welding, soldering, smithy etc.

3. COMPETENCY:

Prepare a simple job using Sheet metal, Welding and Smithy technique.

a) Cognitive : Understand various trade practices in engineering.
b) Psychomotor: Use of various tools in Sheet metal, Welding and Smithy shop
c) Affective : Develop **a**ttitude of i) Interpret drawing ii) Safety practices

4. COURSE OUTCOMES:

CCG 116-1: Select different types of Sheet metal and Welding tools.
CCG 116-2: Prepare the Sheet metal, Welding and Smithy components.
CCG 116-3: Interpret drawing.
CCG 116-4: Practicing safety in workshop.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	1	-	-	3	-	-	-	2	-
CCG116-1	1	-	-	3	-	-	-	2	-
CCG116-2	1	-	-	3	-	-	-	2	-
CCG116-3	1	-	-	3	-	-	-	2	-
CCG116-4	1	-	-	3	-	-	-	2	-

6. PRACTICAL WORK:

Sr. No.	Topics/ Sub-Topics	Skills/ Competencies to be developed	Practical (Hours)/ Evaluation (Marks)
Course outcome: CCG 1 to CCG 4			
1	**Sheet Metal Shop: -** Demonstration of different sheet metal tools and machines. Demonstration of sheet metal operations like Sheet cutting, Bending, Edging, End curling, Lancing, Riveting etc. One Job involving sheet metal operations from Dustbin, Letter Box, Tray, Bucket etc.	a) Study of sheet metal tools, identifying materials b) Measuring dimensions c) Interpretation of drawing d) Operating sheet cutting bending machines e) Time management and observing safety habits f) Prepare utility article	12/20
Course outcome: CCG 1 to CCG 4			
2	**Welding shop**: - a) Demonstration of various welding tools, joints of metals, type of welding machines. b) Demonstration of arc welding techniques. c) How to use current setting, Earthing connection etc. and any one job composite job involving Butt, Lap joint from the following pieces of work - 1) Window frame. 2) Grill. 3) Sanitary window frame. 4) Supporting frame. 5) Stool frame. 6) Bench frame etc. measure dimensions.	a) Study of welding tools, Identifying materials b) Measuring dimensions c) Interpretation of drawing d) Operating welding machines. Time management and observing safety habits	12/20

Sr. No.	Topics/ Sub-Topics	Skills/ Competencies to be developed	Practical (Hours)/ Evaluation (Marks)
Course outcome: CCG 1 to CCG 4			
3	**Smithy shop: -** a) Demonstration of different forging tools. b) Demonstration of different forging processes like Shaping, fullering, setting down operations etc. c) One job like hook, flat chisel or any hardware item Note - One job of standard size (saleable/marketable article per student)	a) Studying forging tools, Identifying materials b) Measuring dimensions c) Interpretation of drawing d) Selection of tools Time management and observing safety habits	08/10

The students will submit the following.

Workshop record book showing the details of the job viz. Drawing, Raw material size, time required completing the job.

The journal consisting of the neat sketches, specifications use of the hand tool, and hand operations based on the demonstration in all the trades during the practical work.

7. ASSESSMENT CRITERIA FOR PRACTICAL AND PRACTICAL EXAMINATION

a) Assessment Criteria for Practical:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 50 marks as per following criteria:

Domain	Particulars	Marks out of 50
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
	Decency and presentation	10
TOTAL		**50**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted

Final marks of practical shall be awarded as per *Assessment Pro-forma II.*

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality Decency and presentation	05
TOTAL		**25**

b) Criteria for assessment at term end practical exam:

Every student has to perform one practical within 2 hours at term end practical exam which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	10
2	Correct figures / diagrams	10
3	Skill (Finishing in dimensions)	20
4	Safety / use of proper tools	10
	Total	50

8. INSTRUCTIONAL STRATEGIES: -

Instructional Method

i) Demonstration during Practicals.
ii) Workshop Record Book.

Teaching and learning resources: -

i) Shop Demonstration
ii) Hands on training on machine.

9. REFERENCE: -

a) Books:

Author	Title	Publisher
S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat Rai & Co.

b) Websites:

i) http://nptel.ac.in
ii) www.egr.msu.edu/~pkwon/me478

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COURSE ID: ME

Course Name : SPORTS & YOGA (CE/ME/EE/MT/IE/ET/IT)
Course Code : CCG117
Course Abbreviation : GSPY

1. TEACHING SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	NIL	02
Practical	02	

2. COURSE OBJECTIVES:

1. To make the students understand the importance of sound health and fitness principles as they relate to better health.
2. To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
3. To create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.
4. To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

3. COURSE OUTCOMES:

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

i. Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
ii. Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
iii. Learn breathing exercises and healthy fitness activities
iv. Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
v. Perform yoga movements in various combination and forms.
vi. Assess current personal fitness levels.
vii. Identify opportunities for participation in yoga and sports activities.
viii. Develop understanding of health-related fitness components: cardio respiratory endurance, flexibility and body composition etc.
ix. Improve personal fitness through participation in sports and yogic activities.
x. Develop understanding of psychological problems associated with the age and lifestyle. (xi)Demonstrate an understanding of sound nutritional practices as related to health and physical performance.
xi. Assess yoga activities in terms of fitness value.
xii. Identify and apply injury prevention principles related to yoga and physical fitness activities.
xiii. Understand and correctly apply biomechanical and physiological principles elated to exercise and training.

4. CONTENT:

Sr. No.	Topics / Sub-topics
1	**Introduction to Physical Education** 1) Meaning & definition of Physical Education 2) Aims & Objectives of Physical Education 3) Changing trends in Physical Education
2	**Physical Fitness, Wellness & Lifestyle** 1) Meaning & Importance of Physical Fitness & Wellness 2) Components of Physical fitness 3) Components of Health-related fitness 4) Components of wellness 5) Preventing Health Threats through Lifestyle Change 6) Concept of Positive Lifestyle
3	**Introduction to Ashtang Yog** Meaning & Importance Yam, Niyam, Aasan, Pranayam, Pratyahar, Dharana, Dhyan & Samadhi
4	**Postures** 1) Meaning and Concept of Postures. 2) Causes of Bad Posture. 3) Advantages & disadvantages of weight training. 4) Concept & advantages of Correct Posture. 5) Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis. 6) Corrective Measures for Postural Deformities
5	**Yoga** 1) Meaning & Importance of Yoga 2) Elements of Yoga 3) Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas 4) Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana) 5) Relaxation Techniques for improving concentration - Yog-nidra
6	**Pranayam & its types** • Meaning & Importance of Pranayam • Breathing Exercises: Slow & Fast, Kapalbhati 1) Nadishodhan (Anulom- Vilom) 2) Sheetali 3) Sitkari 4) Ujjayi 5) Bhramari 6) Bhastrika
7	**Yoga & Lifestyle** 1) Asanas as preventive measures. 2) Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana. 3) Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana,

Sr. No.	Topics / Sub-topics
	Trikonasana, Ardh Matsyendrasana. 4) Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana. 5) Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana. 6) Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.
8	**Sun Salutation (Suryanamaskar)** 1) Meaning and concept of Suryanamaskar 2) Postures 3) Use of breathing techniques and Mantras
9.	**Yogasan** 1) Meaning and Importance of Yogasan 2) Types of Yogasan: Naukasan, Dhanurasan, Garudasan, Virasan, Sarvangasan, Matsyasan, Parighasan, Ushtrasan, Hansasan & Mayurasan
10	**Prayer** 1) Meaning and Importance of Prayer 2) Omkar Chanting 3) Meditation & Mudras
11.	**Psychology & Sports** 1) Definition & Importance of Psychology in Physical Edu. & Sports 2) Define & Differentiate Between Growth & Development 3) Adolescent Problems & Their Management 4) Emotion: Concept, Type & Controlling of emotions 5) Meaning, Concept & Types of Aggressions in Sports. 6) Psychological benefits of exercise. 7) Anxiety & Fear and its effects on Sports Performance. 8) Motivation, its type & techniques. 9) Understanding Stress & Coping Strategies.
12.	**Sports / Games** Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc. 1) History of the Game/Sport. 2) Latest General Rules of the Game/Sport. 3) Specifications of Play Fields and Related Sports Equipment. 4) Important Tournaments and Venues. 5) Sports Personalities. 6) Proper Sports Gear and its Importance.

5. INDUSTRIAL EXPOSURE:

SN	Mode of Exposure	Topic
1.	Visit to nearest Yoga & Sports Centre	Syllabus

6. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and Demonstrations with Practices
ii) Yoga room & Ground Practices

Teaching and Learning Resources:

i) LCD Projector
ii) Visual Streaming

7. REFERENCE MATERIAL:

Books:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light on Yoga by B.K.S. Iyengar.
3. Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority Paperback – by B.K.S. Iyengar
4. Light on the Yoga Sutras of Patanjali Kindle Edition **by B. K. S. Iyengar**
5. Yoga for Sports: A Journey Towards Health and Healing Kindle Edition **by BKS Iyengar**

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LEVEL - II
LIFE SKILLS AND PROFESSIONAL SKILLS COURSES

Course ID: ME

Course Name : INTRODUCTION TO IT SYSTEM (CE/ME/EE/MT/IE/ET/IT)
Course Code : CCG201
Course Abbreviation: GITS

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : NIL

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	2	4
Practical	2	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	--	i. 25 marks for each practical ii. One PST of 25 marks	--	As per Proforma-II	
Marks	**--**	As per Proforma-II	**--**	**50 I**	**50**

I – Internal Assessment

2. RATIONALE:

Computers play a vital role in various fields like business, academics, defence, budget, research, engineering, medicine. In the present Industrial & commercial environment, the technician is expected to use computers skilfully.

This course is intended to make students comfortable with computing environment - Understanding Computer Hardware, Learning basic computer skills, basic application software tools, basic knowledge and applications of Internet and Cyber security awareness.

3. COMPETENCY:

Apply Fundamental knowledge of computer system to work with simple applications.

a) Cognitive : i) State the basic parts of a computer system and relationships among component.
ii) Describe characteristics and functions of CPU's, motherboard, RAM, Storage devices

b) Psychomotor: i) Identify computer system and Network ii) Create word documents, spreadsheets and presentation

c) Affective : Attitude of i) Precision ii) Accuracy iii) Safety iv) Punctuality

4. COURSE OUTCOMES:

CCG201-1: State basic components & applications of a computer system.

CCG201-2: Classify system and application software of a computer system.

CCG201-3: Design files of word processors, spreadsheets, presentation software, and database application

CCG201-4: Describe importance of Internet and cyber law.

5. COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

PO	PO1	PO2	PO 3	PO 4	PO 5	PO6	PO 7	PSO1	PSO2
Competency and COs	Basic and discipline specific knowledge	Problem Analysis	Design/Development of solutions	Engineering Tools, experimentation and testing	Engineering practices for society, sustainability and environment	Project Management	Lifelong Learning	Work in mfg& service sector	Start entrepreneurial activity
COMPENTENCY	3	1	3	2	2	1	3	2	1
CCG201-1	3	-	-	2	1	-	2	-	-
CCG201-2	3	1	-	2	1	-	2	-	-
CCG201-3	3	3	3	3	2	1	-	2	1
CCG201-4	3	-	-	2	3	-	3	-	1

6. CONTENT

A. Laboratory Work:

Laboratory experiments and related skills to be developed:

Sr. No	Title of Experiment	Skills to be developed	Course Outcome
1	Identify system unit, connections of internal components and input/output devices.	1. Identify different components inside the CPU cabinet. 2. Identify input/output and storage devices.	CCG201-1
2	Manage files and folders.	1. Create, copy, rename, delete, move files and folders.	CCG201-1
3	Install and configure device driver for printer and scanners	1. Install driver software for a printer, Scanner 2. Set up a printer & scanner Scan a page, print a test page	CCG201-1 & CCG201-2
4	Identify configuration of OS & Computer system.	1. Understanding the concept of system and application software. 2. Use start icon, taskbar, Recycle Bin, My Computer icon, The Recycle Bin and deleted files	CCG201-2
5	Creating and editing a word document	1. Use of menus and submenus. 2. Type and format the text matter in paragraphs. 3. Set up page size, margins 4. Insert headers and footers, bullets. 5. Use of borders and shading	CCG201-3

		6. Format picture, word-art, text box etc. 7. Typing text in multi-columns Use of equation editor	
6.	Inserting table and Mail-Merge	Table: 1. Insert, format Table. 2. Sort data in table Mail-Merge: 1. Create main document and data source 2. Merge the main document and data source. 3. Merge to file and merge to print.	CCG201-3
7.	Creating and Editing a Spreadsheet	1. Use of menus and submenus. 2. Creating a table in worksheet. 3. Insert formulas, IF condition and functions. 4. Apply sort, filter and data validations. 5. Set up page size, margins. & Set the print area.	CCG201-3
8	Creating and editing a presentation.	1. Insert new / duplicate slides 2. Create objects on a slide and use general editing operations. 3. Use of different views in presentation 4. Apply standard templates for slides. Use preset animation, slide transition and Prepare speaker notes.	CCG201-3
9	Apply advance features of slide-show	1. Use of custom animation effect 2. Use of action buttons on slides 3. Rehearse time-setting of slide show	CCG201-3
10	Internet Basics	1. Check internet connections & its properties. 2. Configure Browser settings and use browser. 3. Use search engines. 4. Visit various website, Digital India portals (state and national portals) and college portals	CCG201-4
10	Making use of Internet (Email, virus protection.)	1. Register for e-mail ID. 2. Communicate with others using e-mail 3. Installation, use of Anti-virus software,	CCG201-4
11	Mini Project	Mini Project based presentation, database & spreadsheet handling, word processing skills.	CCG201-1 to 4

B. THEORY

Section I

Sr. No.	Topics / Sub-topics	Lectures (Hours)
CCG201-1: State basic components & applications of a computer system.		
1	**INTRODUCTION TO COMPUTERS** **1.1 Introduction to Information Technology** **1.2 Basic computer components: -**Block of Computer System, I/O Unit, CPU, ALU, Memory Unit. **1.3 Internal System Components**: - Processor, Motherboards, RAM, ROM, Graphics Cards, Sound Cards, HDD, SSD (Introduction to latest devices for all above points) **1.4 External System Components: -** Introduction to Input Devices- Keyboards, mouse, joystick, pen, scanners, (Introduction to latest types) Output Devices-Monitors, Projectors, Speakers, Printers (Introduction to latest types) **1.5 Secondary Storage Devices: -** CD/DVD, USB/ Flash Dives, External Hard Disks (Introduction to latest types) **1.6 Applications of IT** –Education, Medical, Computer application in Offices, data analysis, accounting, Investment, inventory control, graphics, database management, Instrumentation, Airline and railway ticket reservation, robotics, artificial intelligence, military, design and research work, financial transaction terminals.	6
CCG201-2: Classify system and application software of a computer system.		
2	**INTRODUCTION TO SOFTWARE** **2.1 Types of software** **2.1.1 System software –** Introduction to Operating System (Various Examples of Desktop and Mobile Operating Systems), Device Drivers, Device Manager **2.1.2 Application Software**: Terminology, Examples – Word Processing, Spreadsheets, Presentation tool, Image & Video Editing Software, Database Management applications	4
CCG201-3: Design files of word processors, spreadsheets, presentation software, and database application.		
3	**WORD PROCESSING AND SPREAD SHEETS:** **3.1 Creating and Editing a Document** 3.1.1 Changing Layout of a Document (Design, Margins, Page Orientation, Borders, Themes, Watermark) 3.1.2 Inserting Elements to Word Documents (Shapes Charts, Image, Header Footer, Page number) 3.1.3 Working with Tables 3.1.4 Mail Merge **3.2 Creating and Editing a Spreadsheet** 3.2.1 Changing Layout of a Spreadsheet (Design, Margins, Page Orientation, Borders,) 3.2.2 Inserting Elements to Spreadsheet (Shapes Charts, Image, Header	8

Sr. No.	Topics / Sub-topics	Lectures (Hours)
	Footer, Page number) 3.2.3 Working with Formulas and Data Validation 3.2.4 Working with Sorting and Filtering	
4	**PRESENTATION AND DATABASE:** **4.1 Creating and Editing a Presentation** 4.1.1 Changing Layout of a Presentation (Slide Design, Orientation, Themes, Animation) 4.1.2 Inserting Elements to Presentation (Shapes Charts, Image, Header Footer, Page number) 4.1.3 Preparing Slide Show **4.2 Creating and Editing a Database**	6
CCG201-4: Describe importance of Internet and cyber laws.		
5	**COMPUTER NETWORKS** 5.1 Basic elements of a communication system 5.2 Introduction to Digital & Analog data 5.3 Types of Networks: LAN, MAN, WAN 5.4 Virus, Types of Viruses, Virus Protection	4
6	**INTERNET & CYBER LAWS** 6.1 Internet basic terminology – Web page, Web site, WWW, HTTP, HTML, 6.2 Client, server concepts 6.3 Introduction to ISP with example 6.4 Various examples of Browsers, Search Engines 6.5 Awareness about Digital India portals (state and national portals) and college portals. 6.6 Introduction to Cyber Law 6.7 Information Technology Act of India 2000, 2008	4

7. ASSESSMENT CRITERIA FOR PRACTICAL WORK AND PRACTICAL EXAM

Progressive Skills Test: Criteria for Continuous Assessment of Practical work and

a) Progressive skill Test:

Sr. no	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Preparedness for practical	02
3	Neat & complete Diagram.	04
4	Observations & computer handling skill	02
5	Use of toolbar, menu bar and short cut keys.	04
6	Logical thinking and approach	04
7	Oral Based on Lab work and completion of task	04
	TOTAL	25

Assessment at semester end practical exam as per Pro-forma II.

b) Criteria for assessment at semester end practical exam:

Sr. no	Criteria	Marks allotted
1.	Technical ability	20
2.	Communication skill	10
3.	Logical approach	20
	TOTAL.	50

8. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Discussions
ii) Regular Home Assignments.
iii) Laboratory experiences and laboratory interactive sessions

Teaching and Learning resources:

i) Chalk board
ii) Slides (PPT)
iii) Self-learning Online Tutorials

9. REFERENCE MATERIAL:

a) Books / Codes

Sr. No.	Author	Title	Publisher
1.	Sanjay Saxena	A first course in Computers 2003 edition	Vikas Publishing House Pvt Limited
2.	Anita Goel	Computer Fundamentals	Pearson Education India
3.	Sudipto Das	A Complete Guide to Computer Fundamentals	Laxmi Publications
4.	P.K. Sinha	Computer Fundamentals	BPB Publication

b) Websites

i) https://www.tutorialspoint.com/computer_fundamentals/index.htm
ii) http://kvsecontents.in/computer-fundamentals
iii) https://www.javatpoint.com/computer-fundamentals-tutorial
iv) https://www.tutorialspoint.com/information_security_cyber_law/quick_guide.htm
v) https://www.tutorialspoint.com/internet_technologies/internet_overview.htm

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COURSE ID: ME

Course Name : COMMUNICATION SKILLS IN ENGLISH
Course Code : CCG203
Course Abbreviation: GCMS

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End		Total
	Theory	Practical	Theory	Practical *	
Details of Evaluation	Average of two tests of 20 marks each to be converted out of 10 marks	One Mid-Term Skill Test (2 hrs.)	Term End Theory Exam (02 hours)	Term End Practical Exam (02 hours)	
Marks	**10**	As per Proforma II	**40**	**50 I**	**100**

I- Internal Examination

2. RATIONALE:

Communication being an integral part of every personal and professional human activity, communication skills play a fundamental role in education as well as technology. As unanimous feedback from the industry in general, technicians need to be specially strengthened in communication skills for their effectiveness in profession and career. Considering the age group and socio-economical background of the students of the Institute, this course has been designed with a skill-oriented content with some necessary theoretical foundation. For mastery and perfection in these skills, consistent practice and integrated application is necessary in all subjects of the Programme.

3. COMPETENCY:

Apply principles of communication to communicate in formal and informal scenario as follows:

a) Cognitive : Understanding and applying principles of communication in various situations

b) Affective : Attitude of i) perfection ii) iii) confidence iv) punctuality v) aesthetic presentation

c) Psychomotor : i) Use of correct pronunciation, tone, accent & intonation
ii) Writing formal letters, drafts, reports, draft e-mails and prepare technical documents etc.
iii) Use of correct nonverbal code in formal & informal situations
iv) Speaking in formal & informal situations

4. COURSE OUTCOMES:

CCG203-1 Understand the concept of Communication and identify Communication barriers.
CCG203-2 Deliver Speeches to express thoughts, ideas and emotions.
CCG203-3 Write letters, reports, and E-mail in correct language.
CCG203-4 Make effective use of body language & graphical communication.
CCG203-5 Prepare and present simple media aided presentation.
CCG203-6 Prepare and face interview.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	3	2	3	-	2	2	2		
CCG203-1	2	2	2	-	-	1	-		
CCG203-2	3	2	3	-	2	-	2		
CCG203- 3	2	2	3	-	2	2	1		
CCG203-4	2	2	2	-	2	-	2		
CCG203-5	2	2	2	-	-	-	-		
CCG203-6	2	2	3	-	2	-	-		

6. CONTENT:

A. LAB/PRACTICAL WORK

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as practical assignments as given in the *Workbook on Communication Skills* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be Developed	Course Outcome
1.	Characteristics of Communication Process	Analysis of communication process	CCG203-1
2.	My Communication Barriers	Self-analysis	CCG203-1
3.	Oral Communication: Prepared Speech	Preparing and delivery	CC G203-2
4.	Oral Communication: Extempore Speech	Creative thinking and speaking	CC G203-2
5.	Oral Communication: Conversation	Listening, thinking and speaking	CC G203-2
6.	Oral Communication: Group Discussion	Listening, thinking and convincing	CC G203-2
7.	Oral Communication: Group Debate	Listening, thinking and convincing	CC G203-2

8.	Written Communication: Writing formal Letters	Drafting	CCG203-3
9.	Written Communication: Writing Reports	Drafting with comprehension	CCG203-3
10.	Written Communication: Drafting of E-mail	Drafting	CCG203-3
11.	Written Communication: Technical Writing	Drafting	CCG203-3
12.	Non-verbal Communication: Graphic Communication	Graphic skills	CCG203-4
13.	Non-verbal Communication: Body Language	Body language	CCG203-4
14.	Using Presentation Aids	Preparing Presentation Aids	CCG203-5
15.	Interview Techniques	Facing an Interview	CCG203-6

B. THEORY:			
Sr. No	**Topics / Sub-topics**	**Lectures (Hours)**	**Theory Evaluation (Marks)**
COURSE OUTCOME CCG203-1 Understand the concept of Communication and identify Communication barriers.			
1	**Introduction to Communication** 1.1 Definition and Importance of Communication 1.1 Model of communication 1.1 Principles of effective communication 1.4 Types of communication: Formal, Informal, Oral, Written, Verbal, Non-Verbal, Horizontal, Upward and Downward. 1.5 Barriers in communication: Physical, Mechanical, Psychological and Language.	**10**	**12**
COURSE OUTCOME CCG203-2 Deliver Speeches to express thoughts, ideas and emotions			
2	**Oral Communication** 2.1 Characteristics of Oral Communication. 2.2 Tone, pronunciation and accents. 2.3 Spoken English: Conversation, Prepared and Extempore speech, Group Discussion and Debate.	**08**	**04**
COURSE OUTCOME CCG203-3 Write letters, reports, and E-mail in correct language.			
3	**Written Communication** 3.1 Characteristics of written communication. 3.2 Writing Reports: Accident, Progress & Fall in Production 3.3 Letter Writing: Application with Resume, Enquiry Letter, Complaint Letter and Order Letter. 3.4 E-mail Drafting 3.5 Technical Writing:	**12**	**10**
COURSE OUTCOME CCG203-4 Make effective use of body language & graphical communication.			
4	**Non-verbal communication** 4.1 Importance of Non-Verbal Communication. 4.2 Non-Verbal Codes: Proxemics, Chronemics & Artefacts 4.3 Aspects of Body Language: Facial Expressions, Eye Contact, Vocalics, Gestures, Posture, Dress and Appearance & Haptics. 4.4 Graphical Communication: i) Advantages and Disadvantages of Graphical Communication. ii) Tabulation of Data and its depiction in the form of Bar Graphs and Pie Charts	**06**	**06**
COURSE OUTCOME CCG203-5 Prepare and present simple media aided presentation.			
5	**Media Aided Presentation** 5.1 Media aids for presentation: strengths and precautions 5.2 Planning, preparing and making a presentation 5.3 Use of presentation media.	**06**	**04**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
COURSE OUTCOME CCG203-6 Prepare and face Interview			
6	**Interview Techniques** 6.1 Types of Interviews 6.2 Advantages of Mock Interview. 6.3 Facing an Interview	**06**	**04**
	Total	**48**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course outcome	Total Marks
		Remember	Understand	Applica-tion		
1	Introduction to Communication	02	06	04	CCG203-1	12
2	Oral Communication	00	02	02	CCG203-2	04
3	Written Communication	02	02	06	CCG203-3	10
4	Non-verbal Communication	02	02	02	CCG203-4	06
5	Media aided Presentation	00	02	02	CCG203-5	04
6	Interview Techniques	00	02	02	CCG203-6	04
	Total >>	**06**	**16**	**18**		**40**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS AND PRACTICAL EXAMINATION

a) Assessment Criteria for Practical Assignments:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per criteria given in *Workbook on Communication Skills*.

Domain	Particulars	Marks out of 25
Cognitive	Understanding	06
	Application	06
Psychomotor	Presentation Skills	04
	Drafting skills	05
Affective	Discipline and punctuality	02
	Decency	02
TOTAL		**25**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria given in *Workbook on Communication Skills*

Final marks of practical assignments shall be awarded as per *Assessment Pro-forma II.*

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality Decency and presentation	05
TOTAL		**25**

b) Assessment Criteria for Term-end Practical Examination:

Term-end Practical Examination shall be conducted by internal examiner (course teacher) and external examiner (course teacher of different class from the Institute) as per the following criteria.

Item >	Oral	Written	Total	Marks Converted out of
Marks >	25	25	50	25

9. INDUSTRIAL EXPOSURE:

(Included in *Workbook on Communication Skills*)

SN	Mode of Exposure	Topic
1.	Oral and Written Communication Exercises	Industrial situations
2.	Interview Techniques Exercises	Industrial situations

10. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices
iii) Self-Learning Methods using Language Lab

Teaching and Learning Resources:

i) Chalk board
ii) LCD Projector
iii) Audio Visual Streaming
iv) Item Bank

11. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	K. Sudhesh	Development of Generic Skills	Nandu Printers & Pub, M'bai
2.	M Ashraf Rizvi	Effective Communication Skills	Tata McGraw-Hill
3.	Burgoon Michael	Human Communication	SAGE Publications Inc.
4.	Sanjay Kumar & Pushp Lata	Communication Skills	Oxford University Press
5.	Barun Mitra	Personality Development & Soft Skills	Oxford University Press
6.	Geoffrey Leech and Jansvartvik	A communicative Grammar of English	Pearson Education ESL
7.	Elizabeth Hiemey	101 ways to better communication	Pustak Mahal
8.	Thomas Huckin and Leslie	Technical Writing and Professional Communication	McGraw Hill College Division

b) Websites

i) www.clrp.cornell.edu/workshops/pdf/communication_skills-web.pdf
ii) http://depssa.ignou.ac.in/wiki/images/c/ca/Communication_skills_in_English.pdf
iii) http://www.cgg.gov.in/Handbook%20on%20Communication%20Skills.pdf
iv) http://www.stf-media.com/31-0-Presentations.html
v) www.speaking –tips.com
vi) www.notesdesk.com
vii) www.studylecturenotes.com
viii) http://learnenglish.britishcouncil.org/en/content
ix) www.languagelabsystem.com

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COURSE ID:

Course Name : ENVIRONMENTAL SCIENCE (ME/EE/IE/IT/ET/MT)
Course Code : CCG204
Course Abbreviation : GEVS

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	02	Nil
Practical	-	

2. RATIONALE:

Increase in environmental pollution and depletion of natural resources is causing depletion of ecosystem. Therefore, it is necessary to conserve natural resources and to protect the environment. Environmental studies integrate Physical, Chemical and Biological sciences with the study of the environment. It provides interdisciplinary approach to the study of environmental system & gives solutions of environmental problems.

3. COMPETENCY:

Apply knowledge of environmental science to tackle environment related issues.
Cognitive: Understanding, interpreting issues of environment in engineering practices.
Affective : Skill of curiosity, interest and problem solving related to environmental issues.

4. COURSE OUTCOMES:

CCG204-1 Develop public awareness about environment.
CCG204-2 Select alternative energy resources for Engineering Practices.
CCG204-3 Understand &conserve Ecosystem
CCG204-4 Apply techniques to reduce Environmental Pollution.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	3	2	1	-	3	1	3		
CCG204-1	3	1	1	-	3	1	3		
CCG204-2	3	2	1	-	3	1	3		
CCG204-3	2	1	1	-	2	1	3		
CCG204-4	3	2	2	-	3	2	3		

6. CONTENT:

THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome **CCG204-1** Develop public awareness about environment.			
1	**ENVIRONMENT** 1.1 Definition, need of environmental studies. 1.1 Segments of environment – Atmosphere, Hydrosphere, Lithosphere, Biosphere. 1.1 Environmental issues – Greenhouse effect, Global warming, Acid rain, Ozone layer depletion. 1.1 Concept of 4R (Reduce, Reuse, Recycle & Recover).	**6**	**NA**
Course Outcome **CCG204-2** Select alternative energy resources for Engineering Practices.			
2	**ENERGY RESOURCES** 2.1 Renewable, Non-renewable & Cyclic resources. 2.2 Causes & effects of depletion of resources. 2.3 Energy forms (conventional & non-conventional). 2.4 Energy conservation. 2.5 Over use of natural resources & its impact on Environment.	**10**	**NA**

Section II

Sr. No	Topics / Subtopics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome **CCG204-3** Conserve Ecosystem and biodiversity			
3	**ECOSYSTEM** 3.1 Ecosystem – Definition. 3.2 Division of ecosystem. 3.3 General characteristics of ecosystem. 3.4 Food chain.	**4**	**NA**
Course Outcome **CCG204-4** Apply techniques to reduce Environmental Pollution.			
4	**ENVIRONMENTAL POLLUTION** 4.1 Definition of pollution. 4.2 Types – Natural & Artificial (Manmade) 4.3 Soil / Land pollution – 4.3.1 Causes & effects on environment & lives. 4.3.2 Preventive measures. 4.4 Water pollution – 4.4.1 Sources of water pollution. 4.4.2 Effects on environment & lives. 4.4.3 Preventive measures.	**12**	**NA**

	4.4.4 BIS water quality standards. 4.4.5 Water conservation. 4.5 Waste water – 4.5.1 Generation (Domestic & Industrial). 4.5.2 Impacts. 4.5.3 CPCB norms of sewage discharge. 4.6 Air pollution – 4.6.1 Causes. 4.6.2 Effects. 4.6.3 Prevention. 4.7 Noise pollution – 4.7.1 Sources. 4.7.2 Effects. 4.7.3 Prevention. 4.7.4 Noise levels at various zones of the city. 4.8 Municipal solid waste, Bio-medical waste & e-waste. 4.8.1 Sources. 4.8.2 Generation. 4.8.3 Characteristics. 4.8.4 Effects & methods to manage.		

7. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Discussions
ii) Regular Home Assignments.
iii) Visit to relevant Industries/ Public places

Teaching and Learning resources:

i) Chalk board.
ii) Video clips.
iii) Slides
iv) Charts

8. REFERENCE MATERIAL:

a) Books / Codes

Sr. No.	Author	Title	Publisher
1.	Nazaroff, William, Cohen, Lisa	Environmental engineering science.	Willy, New York, 2000, ISBN 10;0471144940
2.	C.N.R. Rao	Understanding Chemistry	Universities press (India) Pvt. Ltd., 2011
3	Shashi Chawla	A text book of Environmental Studies.	Tata Mc Graw-Hill New Delhi.
4	Arvind Kumar	A text book of Environmental Science.	APH Publishing New Delhi.
5	Rao, C.S.	Environmental Pollution Control and Engineering.	New Age International Publication, 2007, ISBN: 81-224-1835-X

b) Websites

i) http://www.conserve-energy-future.com
ii) http://www.cpcp.gov.in
iii) http://www.indiaenvironmentportal.org.in
iv) http://www.eco-prayerl.org
v) http://www.sustainable development.un.org
vi) http://www.whatis.techtarget.com

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COURSE ID: ME

Course Name : ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
Course Code : CCG205
Course Abbreviation : GITK

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	02	00
Practical	00	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End		Total
	Theory	Practical	Theory	Practical *	
Marks	From the assessment of submission on given topics the teacher should evaluate the student and assign him grades as mentioned at ##.				

2. RATIONALE:

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course is introduced to get knowledge in Indian Philosophical Foundations and to know Indian Languages and Literature and the fine arts in India & their Philosophy. It also aims to explore the educational system, Science and Scientists of Ancient, Medieval and Modern India.

3. COMPETENCY:

Ability to interpret, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

a) Cognitive : Summarize philosophy of Indian culture and distinguish the Indian languages and literature among difference traditions.
b) Psychomotor: Acquire the information about the fine arts in India.
c) Affective : Attitude of Unity in diversity, Tolerance and Universal acceptance, cultural synthesis and values of life.

4. COURSE OUTCOMES:

CCG205-1: Summarize and classify philosophy of Indian culture of ancient, medieval and modern India.
CCG205-2: Distinguish the Indian languages and literature among different traditions.
CCG205-3: Differentiate between Dharma and Religion.
CCG205-4: Acquire the information about the fine arts in India.
CCG205-5: Study the contribution of education systems of different eras in India.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	-	-	-	-	1	-	-	-	-
CCG205-1	-	-	-	-	1	-	-	-	-
CCG205-2	-	-	-	-	1	-	-	-	-
CCG205-3	-	-	-	-	1	-	-	-	-
CCG205-4	-	-	-	-	1	-	-	-	-
CCG205-5	-	-	-	-	1	-	-	-	-

6. CONTENT:

Practical Assignments and related skills to be developed:

The following practical exercises / assignments shall be conducted and the student should be assessed for attainment of the competency (any 08 assignments).

Sr No.	Title of Practical Exercise	Skills / Competencies to be Developed	Course Outcome
16.	Write the definition of Health according to WHO and describe important components of it.	1) Interpret the definition of Health. 2) Understand different components of Health.	CCG205-1
17.	Give introduction of any one religious book.	1) Search different religious books. 2) Select a religious book of our own choice and study it.	CCG205-2
18.	Collect information about "Anapansati", the method of meditation. Conduct a session of Anapansati with your family members, submit photographs of the session, and discuss the after effects amongst the meditators.	1) Collect information about meditation methods. 2) Meditate and interpret the mental state before and after the meditation sessions.	CCG205-3
19.	Write an essay on any one Indian traditional festival. Prepare a relevant festival dish and submit a photograph of the dish.	1) Gather the information about Indian traditional festivals. 2) Understand the science and psychology behind the festive culture of India.	CCG205-3
20.	Collect pictures / photographs of any five objects received during the excavation of "Sindhu culture" era and write their descriptions.	1) Search the pictures / photographs of ancient age. 2) Read and interpret information about our heritage.	CCG205-4
21.	Prepare / construct any model (like pair of oxen, figurine of God or human face etc.) from soil, mud, clay or any other material	1) Construct a model using soil. 2) Enjoy the artistic experiences.	CCG205-4

22.	Collect and write information of any five herbal medicinal plants. Grow one of them and submit the photograph.	1) Search herbal medicinal plants and interpret their applications. 2) Grow different types of plants.	CCG205-4
23.	Collect information about "Nalanda University" and write a short-note about it with reference to its establishment, progress, contribution, causes of destruction etc.	1) Collect information of Indian ancient universities. 2) Interpret their contribution in building India as a nation.	CCG205-5
24.	Write a descriptive note on the role of Indian mathematician in the development of mathematics.	1) Collect information about ancient Indian scientists and mathematicians. 2) Prepare a write-up of great Indian scientists – mathematicians.	CCG205-5
25.	Prepare a role play (in a group of 5 / 6 students) based on "Daily life in Gurukul".	1) Conduct a role play on any topic. 2) Understand value-based education and its significance in daily life.	CCG205-5
26.	Write a descriptive note on "Maritime Trade in Ancient India".	1) Gather information about trad in ancient India. 2) Understand the position of India in world trade market and India's contribution in it.	CCG205-4

7. THEORY

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)
CCG205-1: Understand philosophy of Indian culture of ancient, medieval and modern India.		
1.	**Introduction to Indian Philosophy**: 1.1 Basics of Indian Philosophy 1.2 culture & civilization 1.3 culture and heritage 1.4 Importance of culture in human literature 1.5 General characteristics of Indian culture – Unity in diversity, Tolerance and Universal acceptance, वसुधैव कुटुंबकम् (The World is a family), Freedom of worship (**रुचीनां वैचित्र्यादृजुकुटिलनानापथजुषाम्। नृणामेको गम्यस्त्वमसि पयसामर्णव इव॥**), **Cultural synthesis- not cultural conflicts, unbroken traditions,** 1.6 Indian culture Ancient India, Medieval India, Modern India.	**4**
CCG205-2: Distinguish the Indian languages and literature among different traditions		
2.	**Indian Philosophy & Literature:** 2.1 Tradition of metaphysical knowledge 2.2 Vedas & Upanishads 2.3 Schools of Vedanta, and other religion Philosophical Literature 2.4 Philosophical Ideas	**6**

	2.5 The role of Sanskrit 2.6 Significance of scriptures to current society Indian languages and literature of India.	
CCG205-3: Differentiate between Dharma and Religion.		
3.	**Dharma, Religion and Philosophy:** 3.1 Meaning of Dharma as duties of Human being, (जगतः स्थितिकारणं प्राणिनां साक्षात् अभ्युदयनिःश्रेयसहेतुर्यः स धर्मः, आगमानां हि सर्वेषाम् आचारः श्रेष्ठ उच्यते । आचारप्रभवो धर्मो धर्मादायुर्विवर्धते ।।) 3.2 Dharma and Religion 3.3 Religious Philosophy in ancient India 3.4 Religious Philosophy in Medieval India Religious Reform Movements in Modern India (selected movements only)	**6**
CCG205-4: Acquire the information about the fine arts in India		
4.	**Indian Fine Arts & Its Philosophy (Art, ,Science Technology & Engineering):** 4.1 Indian Painting 4.2 Indian handicrafts 4.3 Music, divisions of Indian classic music, modern Indian music 4.4 Dance and Drama 4.5 Indian Architecture - ancient, medieval and modern Science and Technology in Indian, development of science in ancient, medieval and modern Indian.	**8**
CCG205-5: Study the contribution of education systems of different eras in India		
5.	**Education System in India:** 5.1 The role of "Gurukul's" in Education System 5.2 Value based Education 5.3 Education in ancient, medieval and modern India, aims of education, subjects, languages Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India.	**8**

8. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS

Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following table.

Domain	Particulars	Marks out of 25
Cognitive	Understanding the objective	05
Psychomotor	Manual work and Observation	10
Affective	Discipline and punctuality	05
	Presentation of concept	05
TOTAL		**25**

Grade to the students should be allotted as follows: -

Range of continuous assessment marks	Grade
continuous assessment marks > 90	A +
90 = / > continuous assessment marks > 85	A
85 = / > continuous assessment marks > 80	B +
80 = / > continuous assessment marks > 75	B
75 = / > continuous assessment marks > 70	C +
70 = / > continuous assessment marks > 60	C

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Discussions
ii) Collaborative mini projects.
iii) Regular Home Assignments.

Teaching and Learning Resources:

i) Chalk board
ii) Video clips
iii) PPT
iv) Charts

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	**श्रीनिवास हरी दीक्षित**	भारतीय तत्वज्ञान	**अजब पुस्तकालय, कोल्हापूर**
2.	S. Radhakrishnan	Indian Philosophy Vol. 1	OUP India ISBN: 9780195698411, 9780195698411 Edition: 2009
3.	Suresh Soni	India's Glorious Scientific Tradition	Prabhat Prakashan ISBN: 9788184300284, 9788184300284
4.	प्रशांत पोळ	भारतीय ज्ञानाचा खजिना	
5.	Krishna Chaitanya	Arts of India	Abhinav Publications, 1987
6.	NCERT	"Position paper on Arts, Music, Dance and Theatre''	ISBN 81-7450-494-X, 2006
7.	Satya Prakash	"Founders of Sciences in Ancient India"	Vijay Kumar Publisher, 1989
8.	Altekar. A. S.	Education in ancient India.	Banaras: Nanda Kishore & Bros. 1948.

b) Websites

i) https://nios.ac.in/online-course-material/secondary-courses/indian-culture-and-heritage-(223)-syllabus.aspx
ii) http://ncert.nic.in/textbook/pdf/heih111.pdf

* * *

COURSE ID: ME

Course Name : INDIAN CONSTITUTION
Course Code : CCG206
Course Abbreviation : GINC

1. TEACHING SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	02	NIL
Practical	NIL	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End		Total
	Theory	Practical	Theory	Practical *	
Marks	From the assessment of submission on given topics the teacher should evaluate the student and assign him grades as mentioned at ##.				

2. RATIONALE:

The course is designed to have basic knowledge of our Constitution, its formation and process of forming the constitution and its importance. Also, it is expected that the student should at least know the political system of nation, state, district and village also.

The judiciary system is also important part in the life of person and it is expected that the diploma student must at least know the system and its provisions in brief.

3. COMPETENCY:

Ability to understand, connect up and explain basics of Indian constitution, Indian Politics and Indian judiciary in brief.

a) Cognitive : Understand philosophy of Indian Constitution and Politics.
b) Psychomotor : Acquire the information about Politics, Judiciary and constitutional provisions.
c) Affective : Know the provisions of constitutions and legal process of changing the provisions in constitutions, political impacts on human life and provisions in judiciary and their importance.

4. COURSE OUTCOMES:

CCG206-1: Understand philosophy of Indian constitution.
CC**G206-2:** Know the formation process of state and central Government.
CCG206-3: Concept of Union Territory and provisions.
CCG206-4: Indian Politics.
CCG206-5: Study the Judiciary system in India.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design / Development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering Practices for society, sustainability and Environment**	**PO 6 Project Management**	**PO 7 Life-long Learning**	**PSO 1 Work in mfg& service sector**	**PSO 2 Start entrepreneurial activity**
Competency	0	1	1	0	1	1	2		
CCG206-1	1	0	1	0	1	1	2		
CCG206-2	0	1	1	1	2	1	2		
CCG206-3	0	1	1	1	1	1	2		
CCG206-4	0	0	1	1	2	2	2		
CCG206-5	0	1	1	1	2	2	3		

6. CONTENT:

A) Suggested Assignments: It is expected that the student should prepare write up of at least 5 topics as a homework and submit report to the teacher before the grant of term.

C) THEORY

SECTION-I

Sr. No	Topics / Sub-topics	Lectures (Hours)
1	**Unit 1.** The Constitution: - 1.1 Introduction. 1.2 The History of making of the Indian Constitution. 1.3 Basic structure and its interpretation. 1.4 Fundamental Rights and Duties and their interpretation	**4**
2	**Unit 2**. Union Government 2.1 Structure of the Indian Union. 2.2 President –Role and power. 2.3 Prime minister and council of ministers. 2.4 Lok Sabha and Rajya Sabha. 2.5 Union Territories and their limitations.	**6**
3	**Unit 3.** State Government. 3.1 Governor –Role and power. 3.2 Chief Minster and council of ministers. 3.3 State secretariat. 3.4 Administrative Regions of Maharashtra.	**6**

SECTION -II		
4	**Unit.4** Local Administration: - 4.1 District Administration. 4.2 Municipal Corporation. 4.3 Zilla Panchayat 4.4 Taluka (Tehsil) Administration.	**4**
5	**Unit 5**. Election Commission. 5.1 Role and functioning. 5.2 Chief Election Commissioner –Appointment. 5.3 State Election Commission. 5.4 Elections and duties of government /non-government servants – introduction	**6**
6	**Unit 6.** Judiciary Provisions: - 6.1 Introduction 6.2 Different courts. 6.3 Government legal advisor-provisions. 6.4 Limitations of courts and co-ordination with home department.	**6**

7. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS: -

It is expected that the student should prepare write up of at least 5 topics as a home work and submit report to the teacher before the grant of term.

1. Indian constitution formation.
2. Indian constitution important provisions.
3. Formation of Indian government process.
4. Power of president and prime minister/important facilities to them.
5. District administration along with administration at municipal corporation, tehsil and jilha panchayat.
6. Election commission and their responsibilities.
7. Judiciary system in India-District courts and their limitations.

Continuous Assessment of Practical Assignments: No practicals but student should write at least 5 assignments on above topics.

Grade to the students should be allotted as follows: -

1. If the scored marks are more than 90 percent – Grade A +
2. If the scored marks are more than 85 percent – Grade A
3. If the scored marks are more than 80 percent – Grade B +
4. If the scored marks are more than 75 percent – Grade B
5. If the scored marks are more than 70 percent – Grade C +
6. If the scored marks are more than 60 percent – Grade C

8. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Discussions.

Teaching and Learning Resources:

i) Chalk board
ii) Video clips
iii) PPT
iv) Suggested websites.

9. REFERENCE MATERIAL:

a) Books

Sr.no	Title of Book	Author	Publication
1	Ethics and Politics of Indian constitution	Rajiv Bhargava	Oxferd University –New Delhi-2008
2	The Constitution of India	B.L.Fadia	Sahitya Bhawan- 2017 edition
3	Introduction to constitution of Indian	D.D.Basu	Lexis Nexis- 2018 Edition
4	Maharashtra Shasan diary		

b) Websites:

Suggested softwares /Learning websites: -

1. https://www.constitution.org/cons/india/const.html
2. https://www.legislative.gov.in/constitution-of-india
3. http://www.sci.gov.in/constitution
4. http://www.toppr.com/guide/civics/the-indian-constitution/the-constitution of india

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LEVEL - III
BASIC TECHNOLOGY COURSES

COURSE ID: ME

Course Name : APPLIED MATHEMATICS
Course Code : MEG301
Course Abbreviation : GAMT

1. **TEACHING AND EVALUATION SCHEME:**

Pre-requisite Course(s) : CCG105, CCG106

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	04
Practical	01	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Tutorials	Theory Examination	Practical Examination	
Details of Evaluation	Average of two tests of 20 marks each	As mentioned in the syllabus	Term End Theory Exam (03 hours)	NIL	
Marks	**20**	**--**	**80**	**--**	**100**

2. RATIONALE:

Mathematics is an important pre-requisite for the development and understanding of engineering and technological concepts. For an engineer and technologist, knowledge of Mathematics is an effective tool to pursue and to master the applications in the engineering and technological fields. Applied mathematics is designed for its applications in engineering and technology. It includes integration, differential equation. The connection between applied mathematics and its applications in real life can be understood and appreciated. Integral calculus helps in finding the area, mean value R. M. S value etc. Differential equation is used in finding curve, rectilinear motion. Statistics and probability will help a student to analyze data of large volume in their higher studies. The fundamentals of these topics are directly useful in understanding engineering applications in various fields.

3. COMPETENCY:

The course should be taught and implemented with the aim to develop the course outcomes (CO's) for the student to acquire the competency needed to apply the mathematical techniques for engineering subjects.

1. Cognitive : understanding and applying principles of mathematics to engineering problems

2. Psychomotor: To prepare charts displaying the area of irregular shapes using the concept of integration, prepare charts to displaying grouped and ungrouped data

3. Attitude : discipline, consistency, hard work, to concentrate, accuracy, punctuality, aesthetics

4. COURSE OUTCOMES(CO's)

MEG301.1 Integrate any integrable function
MEG301.2 Apply the concept of integration to find the areas
MEG301.3 Solve Differential equation of first order and first degree by various methods
MEG301.4 Solve examples of Laplace Transform

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Work in mfg. & service sector	PSO 2 Start entrepreneurial activity
Competency	3	2	2	2	--	--	2		
MEG301.1	3	-	-	-	-	-	2		
MEG301.2	3	2	3	3	2	2	2		
MEG301.3	3	2	2	2	1	2	2		
MEG301.4	3	1	1	2	1	2	2		

6. CONTENT:

A) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG301.1 Integrate any integrable function			
1	**INDEFINITE INTEGRALS** 1.1 Definition, Standard formulae 1.2 Rules of Integration (without proof), Examples 1.3 Integration by substitution 1.4 Integration by parts 1.5 Integration by partial fractions	**12**	**20**
MEG301.1 Integrate any integrable function			
2	**DEFINITE INTEGRALS** 2.1 Definition, Examples 2.2 Properties of Definite Integration (without proof), Examples based on properties	**06**	**10**
MEG301.2 Apply the concept of integration to find the areas			
3	**APPLICATION OF INTEGRATION** 3.1 Area under the curve and 3.2 Area between two curves	**06**	**10**
	Total	**24**	**40**

1. Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.
2. In each topic, corresponding applications will be explained.

Section II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG301.3 Solve Differential equation of first order and first degree by various methods			
4	**DIFFERENTIAL EQUATIONS** 4.1 Definition of differential equation 4.2 Order & degree of Differential equations 4.3 Solutions of Differential equations of first order & first degree of following types 4.3.1 Variables separable 4.3.2 Homogenous Equation 4.3.3 Exact equations 4.3.4 Linear Equations	**12**	**20**
MEG301.4 Solve examples on Laplace Transform			
5	**LAPLACE TRANSFORM** 5.1 Definition, Linearity property 5.2 Laplace Transforms of Standard functions (without proof) and examples 5.3 First shifting property and examples 5.4 Examples on Multiplication by t^n 5.5 Inverse Laplace Transform, Definition 5.6 Standard formulae (without proof) and examples 5.7 Inverse L.T.by using First shifting property 5.8 Inverse L.T. by using Partial fraction method	**12**	**20**
1. Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only. **2**. In each topic corresponding applications will be explained			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (level wise)			Course Outcome	Total Marks
		Remember	Comprehension	Applica-tion		
1	Indefinite Integrals	4	6	10	**MEG301.1**	20
2	Definite Integrals	2	2	10	**MEG301.1**	14
3	Application of Integration	--	--	06	**MEG301.1**	06
4	Differential equations	4	4	12	**MEG301.2**	20
5	Laplace Transformation	6	6	8	**MEG301.3**	20
Total		**16**	**18**	**46**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. TUTORIALS

Note: Tutorials are to be used to get enough practice [One batch for 20 Students]

Sr No.	Topic	Tutorial Content (10 problems in each tutorial)
1	Indefinite Integrals	To evaluate Integration using standard formulae, To evaluate Integration using Substitution Method
2	Indefinite Integrals	To evaluate Integration of Various forms.
3	Indefinite Integrals	To evaluate Integration using by Parts rule and Partial fraction method
4	Definite Integrals	To evaluate Define Integration for various forms and using properties.
5	Application of Integration	Apply Integration concepts to find Area
6	Differential equations	To determine Order and Degree of D.E. Examples on V.S. form, Homogeneous form
7	Differential equations	Examples on Linear of D.E and Exact D.E.
8	Laplace Transformation	Examples on L.T. using standard formulae and first shifting property
9	Laplace Transformation	Examples on L.T using first shifting property and multiplication by t^n
10	Laplace Transformation	Examples on inverse L.T.

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and Demonstrations
ii) Tutorials
iii) Online teaching

Teaching and Learning resources:

i) Chalk board
ii) Item Bank
iii) Charts
iv) Computers

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publisher
1	G.V. Kumbhojkar	Engineering Mathematics III	Phadake Prakashan, Kolhapur
2	Patel, Rawal,	Applied Mathematics	Nirali Prakashan,Pune
3	Sameer Shah	Applied Mathematics	Tech-Max Publication, Pune
4	P. N. Wartikar	Applied mathematics	Pune vidyarthi Griha Prakashan , pune
5	H. K. Dass	Higher engineering mathematics	S. Chand publication
6	B. S. Grewal	Higher engineering Mathematics	Khanna publication, New Delhi

b) Website

i) www.khanacademy.org
ii) www.easycalculation.com
iii) www.math-magic.com

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COURSE ID: ME

Course Name : THERMAL ENGINEERING
Course Code : MEG302
Course Abbreviation : GTEG

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks for each practical ii) One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Examination

2. RATIONALE:

Thermal engineering is one of the core subjects of Mechanical engineering field which includes study of energy, heat, work and conversion between them. Mechanical engineers need to work with various power producing & power absorbing devices like boilers, turbines, compressors, pumps etc. In order to understand the principles, construction & working of these devices, it is essential to understand thermodynamics.

3. COMPETENCY

Apply fundamental concepts and laws of thermodynamics to solve engineering problems as follows:

a) Cognitive : Apply concepts and laws of thermodynamics to various thermal systems

b) Psychomotor: i) Demonstrate thermal equipments ii) Solve problems using steam table and charts

c) Affective : Attitude of i) Safety ii) Punctuality iii) Use of Steam table and Charts iv) Analytical thinking

4. COURSE OUTCOMES:

MEG302-1: Apply fundamental concepts of thermodynamics to various thermodynamic systems

MEG302-2: Interpret various laws of thermodynamics, Ideal gas processes and relative applications

MEG302-3: Describe modes of heat transfer principles

MEG302-4: Calculate properties of two-phase system by using steam tables/ mollier charts

MEG302-5: Comprehend the classification, construction, working and performance of boilers

MEG302-6: Understand the use of steam nozzles, turbines, condensers and cooling tower in thermal power plant

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and CO's	PO 1 Basic and discipline specific knowledge	PO 2 Problem analysis	PO 3 design/ development of solutions	PO 4 Engineering Tools, experimentation and testing	PO 5 Engineering practice for society, sustainability and environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Work in mfg. & service sector	PSO 2 Start entrepreneurial activity
Competency	3	3	2	1	2	1	2	2	2
MEG302-1	3	1	1	1	2	-	2	1	1
MEG302-2	3	2	2	-	-	-	2	-	-
MEG302-3	3	2	2	--	--	--	3	1	1
MEG302-4	3	1	2	1	1	-		2	-
MEG302-5	3	-	2	1	--	--	2	-	-
MEG302-6	2	1	2	--	2	2	2	2	--

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work as detailed in practical sessions of batches of about 22 students:

Sr. No	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Determination of Thermal Conductivity of Metal rod	Experimental Performance observation and interpretation on the set up	MEG302-3
2	Demonstration of construction and working of fire tube boilers & water tube boilers with the help of models charts etc.	Trace path of flue gasses., water and steam circuit in a boiler, interpret steam tables, Mollier chart and relationship between different thermodynamic properties	MEG302-5
3	Demonstration of construction and working of Boiler mountings with the help of above-mentioned training aids	Function, working & use of boiler mountings	

4	Demonstration of construction and working of Boiler accessories	Function, working & use of boiler accessories	
5	Determination of dryness fraction of steam	Measurement of dryness fraction of steam by using separating calorimeter	MEG302-4
6	Study of steam Nozzles and turbine	Function, working use of steam Nozzles and turbine	MEG302-6
7	Study of condenser and cooling towers	Function, working use of condenser, cooling tower in steam power plant	
8	Industrial visit (sugar factory)	Collect information about boiler, accessories, mountings, condenser, cooling tower nozzle and turbines used in industry	MEG302-5, MEG302-6
9	Mini Project	Maintenance, creativeness and latest technology adoption	MEG302-1

b) Microproject:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. 2D drawing: students will collect one or two drawings from the nearby industry/workshop and prepare model and generate 2D drawing production drawings from it.

i) Preparation of charts on various charts
ii) Preparation of models of boiler mountings and accessories
iii) Preparation of models of steam turbine
iv) Case study of small mechanical cooling towers
v) Charts preparation of sugar industry processes

B. INDUSTRIAL EXPOSURE:

i) As per practical no. 5 & 6 expert lectures by prominent personalities from industries.
ii) As per practical no. 7 an Industrial visit of students to Sugar Factory.

C. THEORY:

SECTION-I

Sr. No.	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG302-1: *Apply fundamental concepts of thermodynamics to various thermodynamic systems*			
1.	**FUNDAMENTAL CONCEPTS OF THERMODYNAMICS** 1.1 Concept of pure substance, Thermodynamic system, boundary, surrounding 1.2 Classification of thermodynamic systems: Open system, Closed system & Isolated system with examples 1.3 Properties of system, extensive & intensive properties like specific volume, density, pressure, Temperature, enthalpy, entropy, total volume, Specific enthalpy etc., State of a system, Point function and Path function, thermodynamic process and cycle 1.4 Energy: Potential, kinetic and internal energy, Law of conservation of energy, concept of heat and work, similarities and differences	**06**	**10**
Course OutcomeMEG302-2: *Interpret various laws of thermodynamics, Ideal gas processes and relative applications*			
2.	**LAWS OF THERMODYNAMICS** 2.1 Zeroth law of thermodynamics 2.2 First law of thermodynamics: statement, limitations, Application to close & open System, Flow work, Steady flow energy equation (SFEE), SFEE applied to engineering systems like boiler, condenser, evaporator, nozzle, turbine, pump & compressor (Simple Numerical) 2.3 Second law of thermodynamics: Concept of Perpetual motion machine of first and second kind Kelvin Plank and Clausius statement and their equivalence, application of Second law: Heat engine, heat pump and refrigerator	**08**	**12**
Course OutcomeMEG302-2: *Interpret various laws of thermodynamics, Ideal gas processes and relative applications*			
3.	**THERMODYNAMIC PROCESSES OF IDEAL GASES** 3.1 Ideal gas (perfect gas), Boyle's law, Charle's law, Gay- Lussac's law, Ideal gas equation, Characteristic & universal gas constants, Specific heat at constant pressure & constant volume, ratio of Specific heats 3.2 Ideal gas processes: Isochoric, Isobaric, Isothermal, Adiabatic, Polytropic, Throttling, Representation on P-V and T-S diagrams, Calculation of work done, Heat transfer, Change in internal energy in each process (simple Numerical)	**06**	**10**

Sr. No.	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG302-3: *Describe modes of heat transfer principles*			
4.	**HEAT TRANSFER** 4.1 Modes of heat transfer: conduction, convection and radiation 4.2 Fourier's law, Thermal conductivity, Heat transfer through composite wall (Simple Numericals) 4.3 Newton's law of cooling for convection, types of convection 4.4 Absorptivity (α), reflectivity (ρ) and transmissivity (t) and emissivity, Stefan-Boltzmann Law, Concept of Black Body, Gray body 4.5 Heat exchangers: Classification and Applications	**04**	**08**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	Topics/Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG302-4: *Calculate properties of two-phase system by using steam tables/ mollier charts*			
5.	**PROPERTIES OF STEAM** 5.1 Steam as a pure substance, Generation of steam at constant pressure (T-H, H-S and P-H Diagram) 5.2 Types of steam: wet, dry, superheated steam 5.3 Properties of steam: sensible, latent and total heat, specific volume, dryness fraction 5.4 Determination of enthalpy, internal energy, internal latent heat, entropy, dryness fraction of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart 5.5 Vapour Power cycle Introduction: Carnot cycle, Rankine cycle, modified Rankine cycle	**08**	**12**
Course OutcomeMEG302-5: *Comprehend the classification, construction, working and performance of boilers*			
6.	**STEAM GENERATION** 6.1 Classification of boilers, construction and working of common boilers (Lancashire boiler and Babcock & Wilcox boiler only) 6.2 Mountings and Accessories: Function and locations of Mountings and Accessories on boiler	**06**	**10**

Sr. No	Topics/Sub-topic	Teaching (Hours)	Theory Evaluation Marks
	6.3 Study of high-pressure boilers like Lamont boiler, Loeffler boiler, Benson boiler and velox boiler 6.4 Boiler draught: Objectives, classification, relative merits and Demerits		
Course OutcomeMEG302-6: *Understand the use of steam nozzles, turbines, condensers and cooling tower in thermal power plant*			
7.	**STEAM NOZZLES AND TURBINES** 7.1 Steam Nozzle: Continuity equation, Types of nozzles, concept of Mach No., Nozzle efficiency, applications of nozzle 7.2 Steam Turbines: Principles of working, Classification, construction and working of Impulse and Reaction turbine 7.3 Compounding of steam turbine: Necessity and methods of compounding 7.4 Regenerative feed heating, bleeding of steam	**06**	**10**
Course OutcomeMEG302-6: *Understand the use of steam nozzles, turbines, condensers and cooling tower in thermal power plant*			
8.	**CONDENSERS & COOLING TOWERS** 8.1 Objectives, working of Jet & Surface condensers & differences 8.2 Elements of steam condensing plant 8.3 Dalton's law of partial pressure and its application, concept of condenser efficiency, vacuum efficiency 8.4 Sources of air leakage and its effects 8.5 Cooling towers and spray ponds: types, construction & working	**04**	**08**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Appli-cation		
1	Fundamental Concepts of thermodynamics	04	04	02	MEG302-1	10
2	Laws of thermodynamics	04	02	06	MEG302-2	12
3	Thermodynamic processes of Ideal gases	04	02	04	MEG302-2	10
4	Heat Transfer	02	04	02	MEG302-3	08
5	Properties of Steam	04	04	04	MEG302-4	12
6	Steam Generation	04	04	02	MEG302-5	10
7	Steam Nozzles and Turbines	04	04	02	MEG302-6	10
8	Condenser and Cooling Towers	02	02	04	MEG302-6	08
TOTAL		**28**	**26**	**26**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following criteria

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of term work	05
2	Attendance	05
3	Participation	05
4	Understanding	05
5	Representation	05
	Total	**25**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted.

b) Term-end Oral Examination (External):

Term-end Oral Examination (External) shall be conducted as per the following criteria:

Sr. no	Criteria	Marks allotted
1	Understanding of the subject	16
2	Quality and neatness of term work	16
3	Participation	10
4	Result table / calculations / graphs	08
	Total	**50**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions
ii) Classroom practices
iii) Laboratory experiences and laboratory interactive sessions
iv) Experiences and discussions through industrial visits
v) Time bound assignments

Teaching and Learning resources:

i) Chalk board
ii) Online lectures
iii) Demonstrative kits
iv) Demonstrative charts
v) LCD presentations
vi) Audio presentations
vii) Item Bank

10. REFERENCE MATERIAL:

a) Books

Sr. No.	Author	Title	Publication
01	Domkundwar V. M.	A Course in Thermal Engineering	Dhanpat Rai & Co.
02	P. L. Ballaney	A Course in Thermal Engineering	Khanna Publishers
03	R. S. Khurmi	A Text book of Thermal Engineering	S. Chand & co. Ltd.
04	R. K. Rajput	A Course in Thermal Engineering	Laxmi Publication, Delhi
05	Patel and Karmchandani	Heat Engine Vol. - I & II	Acharya Publication
06	P. K. Nag	Engineering Thermodynamics	Tata McGraw Hill
07	B. K. Sarkar	Thermal Engineering	Tata McGraw Hill

b) Websites

i) http://chemwiki.ucdavis.edu/Physical_Chemistry/Thermodynamics/Ideal_Gas_Processes
ii) http://en.wikipedia.org/wiki/Laws_of_thermodynamics
iii) https://www.boundless.com/chemistry/thermodynamics--2/the-laws-of-thermodynamics/the-three-laws-of-thermodynamics/
iv) http://www2.estrellamountain.edu/faculty/farabee/biobk/biobookener1.html

* * *

COURSE ID: ME

Course Name : MACHINE DRAWING
Course Code : MEG303
Course Abbreviation : GMDR

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s): CCG107

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (04 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Examination

2. RATIONALE:

A Mechanical Engineering Diploma holder, irrespective of his field of operation in an industry, is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of production drawings. Engineer is also expected to possess certain degree of drafting skills depending upon job function, to perform his day-to-day activity i.e., communicating and discussing ideas with his supervisors and passing instructions to his subordinates unambiguously. This course envisages reinforcing and enhancing the knowledge and skill acquired in the earlier two courses viz. Engineering Drawing 1 & 2.

3. COMPETENCY: Prepare production drawing.

a) Cognitive: Read and Interpret production drawing
b) Psychomotor: Draw production drawing
c) Affective: Attitude of i) Analytical Thinking ii) Accuracy ii) Precision iv) Visualization Skill

4. COURSE OUTCOMES:

MEG303.1- Produce auxiliary view using auxiliary plane.
MEG303.2- Use of conventions for representation of material and mechanical components
MEG303.3- Draw intersection of solids
MEG303.4- Select suitable fit and provide tolerance for machine components
MEG303.5- Prepare detail and assembly drawing.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation level: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design /development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 Project Management	PO 7 Life- long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**1**
MEG303.1	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
MEG303.2	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
MEG303.3	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
MEG303.4	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
MEG303.5	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**

6. CONTENT:

A. PRACTICAL WORK

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work as detailed in practical sessions of batches of about 22 students:

Sr No	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Auxiliary views One sheet containing two problems and at least two problems as home assignment in sketch book.	To Draw auxiliary view on given auxiliary plane.	MEG303-1
2	Conventional Representation as per SP – 46 (1988) - one sheet.	Use of standard conventions & representation	MEG303-2
3	Limit, Fit, Tolerances and Machining Symbols - one sheet.	Selection of suitable limits, fits, tolerances and machining symbols	MEG303-4
4	Study of production drawings of any two simple components and its preparation – one sheet	Understand the use of elements of production drawing for actual part manufacturing	
5	Intersection of Solids One sheet containing at least two problems (At least four problems for home assignment in sketch book)	Draw curves of intersection of two solids	MEG303-3
6	Details to Assembly: Preparation of assembly drawing of any one component from its detailed drawing covering surface roughness symbols, limits, fits, tolerances and part list – One sheet (at least two problems as home assignment in sketch book)	Prepare assembly drawing from given detailed drawing	MEG303-5

7	Assembly to Details: Preparation of detailed drawing from the given assembly drawing of any one part covering all the elements of production drawing – One sheet (at least two problems as home assignment in sketch book)	Prepare part drawing from given assembly drawing	MEG303-5
8	One simple problem on assembly and detailed drawing using any CAD Package (Assembly containing maximum 6 to 7 components- minimum)	Prepare assembly and detailed drawing of simple component using CAD software	MEG303-5

b) Micro-project

One micro-project in the group of 4 students to be submitted in a semester. Evaluation shall be of 25 marks and marks should be added in Proforma-III.

Suggested micro project:

i) Prepare model of universal coupling/Oldham's coupling/foot step bearing etc
ii) Visit nearby fabrication workshop and prepare report on various types of welding symbol used for fabrication work
iii) Visit nearby process industries like sugar factory, chemical industries etc and prepare report representing conventional representation of various pipe joints
iv) Visit institute workshop and prepare assembly and detail drawing of machine vice/lathe tailstock/tool post.
v) Any other micro projects suggested by subject faculty on similar line

B. INDUSTRIAL EXPOSURE:

Included in practical no. 3 & 4 and expert lectures by prominent personalities from industry.

C. THEORY:

SECTION-I

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG303-1: *Produce auxiliary view using auxiliary plane systems*			
1	**AUXILIARY VIEWS** 1.1 Study of auxiliary planes, 1.2 Projection of objects on auxiliary planes, Completing the regular views with the help of given auxiliary views (Use first angle method of projection)	**06**	**08**
Course OutcomeMEG303-2: *Use of conventions for representation of material and mechanical components*			
2	**CONVENTIONAL REPRESENTATION** 2.1 Standard conventions using SP – 46 (1988) (a) Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber (b) Long and short break in pipe, rod and shaft. (c) Ball and Roller bearing, pipe joints, cocks, valves, internal / external threads (d) Various sections- Half, removed, revolved, offset, partial and aligned sections (e) Knurling, serrated shafts, splined shafts and chain wheels. (f) Springs with square and flat ends, Gears, sprocket wheel (g) Countersunk & counter bore (h) Tapers	**04**	**08**
Course OutcomeMEG303-4: *select suitable fit and provide tolerance for machine components*			
3	**ELEMENTS OF PRODUCTION DRAWING** 3.1 Characteristics of surface roughness: Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods 3.2 Introduction to ISO system of tolerance, dimensional tolerances, elements of interchangeable system, hole & shaft basis system, limits, fits & allowances. Selection of fit (Simple Numerical) 3.3 Geometrical tolerances, tolerances of form, position & its Representation 3.4 General welding symbols, sectional representation and symbols used in Engineering practices	**06**	**12**
Course Outcome MEG303-3: *Draw intersection of solids*			
4	**INTERSECTION OF SOLIDS** 4.1 Curves of intersection of the surfaces of the solids in the following cases; (a) Prism with prism, Cylinder with cylinder, Prism with Cylinder; when (i) the axes are at 90° and intersecting ii) The axes are at 90° and Offset	**08**	**12**

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
	(b) Cylinder with Cone When axis of cylinder is parallel to both the reference planes and cone resting on base on HP and with axis intersecting and offset from axis of cylinder		
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	Topics/Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG303-5: *Prepare detail and assembly drawing*			
5	**DETAILS TO ASSEMBLY** 1.1 Introduction 1.2 Preparation of the assembly drawing from the given detailed drawing of various machine components or parts a) Couplings – Universal couplings & Oldham's Coupling, b) Bearing – Foot Step Bearing & Pedestal Bearing c) Lathe tool Post d) Machine vice & Pipe Vice e) Screw Jack f) Steam Stop Valve	**12**	**20**
Course OutcomeMEG303-5: *Prepare detail and assembly drawing*			
6	**ASSEMBLY TO DETAILS** 6.1 Introduction 6.2 Preparation of detailed working drawing from the given assembly drawing of machine component or part a) Pedestal Bearing b) Lathe Tail Stock c) Drilling Jig d) Piston & connecting rod e) Gland and Stuffing box Assembly f) Valve – Not more than eight parts g) Fast & loose pulley	**12**	**20**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Auxiliary Views	04	02	02	MEG303-1	08
2	Conventional Representation	03	02	03	MEG303-2	08
3	Elements of Production Drawing	04	02	06	MEG303-4	12
4	Intersection of solids	04	02	06	MEG303-3	12
5	Details to Assembly	06	06	08	MEG303-5	20
6	Assembly to Details	06	06	08	MEG303-5	20
	Total	27	20	33		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per criteria given below:

Sr. No.	Criteria	Marks Allotted
1	Attendance	05
2	Preparedness for practical	05
3	Correctness and understanding	10
4	Line work and neatness	05
	Total	**25**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria given in proforma-III

b) Term-end Oral Examination (External):

Term-end oral Examination (External) shall be conducted as per the following criteria:

Sr. No.	Criteria	Marks allotted
1	Understanding of the subject	15
2	Quality of term-work	15
3	Dimensioning and judgment without measurement	10
4	Proper use of drawing instruments	10
	Total	**50**

Final Assessment of Oral Examination shall be done as per Pro-forma-III.

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions
ii) Classroom practices
iii) Laboratory experiences and laboratory interactive sessions
iv) Experiences and discussions through industrial visits
v) Time bound assignments

Teaching and Learning resources:

i) Chalk board
ii) Demonstrative kits
iii) Demonstrative charts
iv) LCD presentations
v) Audio presentations
vi) Item Bank

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publication
01	N. D. Bhatt	Machine Drawing	Charotar Publication, Anand
02	IS Code SP 46 (1988)	Code of practice for general engineering drawing.	Engineering Drawing Practice for School and colleges
03	L. K. Narayanan, P. Kannaich, K. VenkatReddy	Production Drawing	New Age International Publication
04	P. S. Gill	Machine Drawing	S. K. Kataria and Sons
05	M. L. Dabhade	Engineering Graphics (For Topic on Auxiliary Views)	
06	Sidheshwar	Machine Drawing	Tata McGraw Hill

b) Websites:

i) http://draftingmanuals.tpub.com/14040/css/14040_49.htm
ii) http://www.roymech.co.uk/Useful_Tables/Drawing/Mech_Drawings.html
iii) http://www.me.metu.edu.tr/courses/me114/Lectures/assembly.htm#1
iv) http://www.fkm.utm.my/~arahim/Assembly%20Drawing.pdf

* * *

COURSE ID: ME

Course Name : MANUFACTURING PROCESSES
Course Code : MEG304
Course Abbreviation : GMPR

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	07
Practical	04	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End		Total
	Theory	Practical	Theory Examination	Practical Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Examination

2. RATIONALE:

Manufacturing processes is a basic technology course for mechanical engineering. It enhances the skills which the students have acquired in workshop practice and basic workshop practice. Manufacturing is the basic area for Diploma Engineers. He/She should be introduced to the basic processes of manufacturing. The course will help the students to get familiarized with working principles and operations like Pattern making, Molding, Casting, Fabrication, Press work etc.

The basic knowledge of these processes will be helpful to select most suitable processes for conversion of raw material into finished product as per the requirement.

3. COMPETENCY:

Select appropriate manufacturing processes for converting raw material into finished product.

a) Cognitive : Understand various manufacturing processes.

b) Psychomotor: Prepare wooden pattern, fabricate component and develop skill of moldings practice

c) Affective : Develop attitude of i) Accuracy ii) Safety

4. COURSE OUTCOMES:

MEG304-1 Select basic manufacturing processes.
MEG304-2 Prepare a wooden pattern.
MEG304-3 Perform moulding practice.
MEG304-4 Understand various casting techniques
MEG304-5 Use of welding process to fabricate a simple job**.**

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design /development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering practices for society, sustainability and environment**	**PO 6 Project Management**	**PO 7 Life-long learning**	**PSO 1 Work in mfg& service sector**	**PSO 2 Start entrepreneurial activity**
Competency	1	-	-	3	-	-	-	2	-
MEG304-1	1	-	-	3	-	-	-	2	-
MEG304-2	1	-	-	3	-	-	-	2	-
MEG304-3	1	-	-	3	-	-	-	2	-
MEG304-4	1	-	-	3	-	-	-	2	-
MEG304-5	1	-	-	3	-	-	-	2	-

6. CONTENT:

A. Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be Developed	Course Outcome
1	One simple wooden Pattern job of maximum 4 students per group, each group should make different type of pattern.	To develop the skill of manufacturing patterns and their allowances	MEG304- 2
2	Demonstration of molding practice and prepare simple mould using wooden pattern	To understand and to identify different molding methods	MEG304- 3
3	One composite welding job having two different joints. (Batch of four students per job.)	To fabricate component by using welding technique.	MEG304- 5
4	Industrial Visit / Demonstration - TIG / MIG welding setup and write report	To know and observe TIG / MIG welding	MEG304- 1&4
5	Assignment on forming processes.	To know forging die nomenclature	MEG304- 1&4

b. MICRO PROJECT

Students should conduct following activity in group of 4-6students and prepare reports of about 5- 10 pages, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

i) Visit an industry /workshop to observe the process like seam, spot, TIG and MIG welding. Collect information on these machines, their specifications and observe these processes critically to get information regarding various accessories (electrodes, current rating etc.) used in these processes.
ii) Visit an industry / workshop to collect information of various forming processes used in industries. Observe shape of input and output products and suggest suitable operation for various jobs.
iii) Prepare a cast model of simple mechanical components like pulley, flywheel.
iv) Visit to foundry and observe casting processes.

B. INDUSTRIAL EXPOSURE:

Sr. No.	Mode of Exposure	Topic
1.	Field visits	Covering theory
2.	Field examples of course application	Term-work assignment

C. THEORY:

SECTION I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome - **MEG304-1** Select basic manufacturing processes. **MEG304-2** Prepare a wooden pattern.			
1	**PATTERN MAKING** 1.1 Pattern making materials (wood, plastics, rubbers, Plasters, waxes, metallic pattern) 1.2 Types of patterns: Single piece pattern, Split pattern, Match plate pattern, Sweep pattern, Skeleton pattern 1.3 Pattern making allowances: Shrinkage, draft, machining, distortion, rapping 1.4 Color coding for patterns and core boxes.	**08**	**10**
Course Outcome –**MEG304-1** Select basic manufacturing processes. **MEG304-3** Perform moulding practice.			
2.	**A) MOULDING / CASTING** 2.1 Molding sand: Green, Dry, Loam, Facing, baking, Parting, Core 2.2 Properties of Molding sand 2.3 Core prints: Horizontal, vertical, hanging, balancing wing 2.4 Molding processes: Green sand, Dry sand, Machine and Shell Molding	**08**	**14**

3.	**B) CASTING** 3.1 Casting Principle 3.2 Die casting methods: Hot chamber die casting method, Cold chamber die casting method 3.3 Melting furnace for ferrous and non ferrous metals: Cupola furnace: Construction and operation, zones, capacity, Temperature range, Induction furnace. 3.4 Defects in casting: Causes and remedies	**08**	**16**

SECTION II

Sr. No	**Topics / Sub-topics**	**Lectures (Hours)**	**Theory Evaluation (Marks)**
Course Outcome –	**MEG304-1** Select basic manufacturing processes. **MEG304-5** Use of welding process to fabricate a simple job.		
4.	**FABRICATION** 4.1 Introduction of welding. 4.2 Classification 4.3 Arc welding: Principle, Applications, Shielded metal arc welding, Sub-merged arc welding 4.4 Resistance welding: Spot, Projection, Seam, Percussion. 4.5 Gas welding techniques, Types of flames, Welding defects. 4.6 Soldering and Brazing: Types, Principle and Applications	**07**	**14**
Course Outcome – **MEG304-1** Select basic manufacturing processes – presswork.			
5.	**PRESS WORKING** 5.1 Types of presses and Specifications 5.2 Press working operations: Cutting, bending, drawing, punching, blanking, notching, lancing 5.3 Die set components: Punch and die shoe, guide pin, Bolster plate, Stripper, stock guide, feed stock, pilot	**07**	**08**
Course Outcome –**MEG304-1** Select basic manufacturing processes – Forming.			
6.	**FORMING PROCESSES:** 6.1 Forging Processes: Drop forging, Upset forging, Press forging. 6.2 Types of Dies: Open die, closed die 6.3 Forging Operations: Fullering, Edging, Bending, Blocking 6.4 Forgeable materials and Forgeability: Forging temperature, Grain flow in forged parts 6.5 Principles of rolling and extrusion 6.6 Hot and cold rolling 6.7 Types of rolling mills 6.8 Different sections of rolled parts. 6.9 Methods of extrusion: Direct, Indirect, Backward &Impact Extrusion 6.10 Advantages, disadvantages and applications	**10**	**18**
	Total	**48**	**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Pattern making	02	04	04	MEG304-1,2 &4	10
2	Moulding	02	06	06	MEG304-1,3 & 4	14
3	Casting	04	06	06	MEG304-1,2& 4	16
4	Fabrication	04	04	06	MEG304-1,4& 5	14
5	Press working	02	02	04	MEG304-1 & 4	08
6	Forming	02	06	10	MEG304-1 & 4	18
	TOTAL	**16**	**28**	**36**		**80**

Semester end examination question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates shall able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	03
	Decency and presentation	02
TOTAL		**25**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria. Final marks of term work shall be awarded as per *Assessment Pro-forma III.*

b) Assessment Criteria for Term-end Oral Examination (External):

Term-end Oral Examination shall be conducted by internal examiner (course teacher) and external examiner (course teacher of different class from the Institute) as per the following criteria.

Item >	Oral	Total
Marks >	50	50

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures

ii) Demonstration during practicals.

Teaching and Learning Resources:

i) Chalk board

ii) LCD Projector

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
2.	B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat rai & Sons
3.	R. K. Jain	Production Technology	Khanna Publication New Delhi
4.	Production Technology	Hindustan Machine Tools (HMT)	Tata Publication

b) Websites:

i) http://nptel.ac.in

ii) www.egr.msu.edu/~pkwon/me478

iii) www.basicmechanicalengineering.com/lathe~machine~operation~basic:turning.operations

iv) www.planomillers.com/drilling.machine.html

v) www.jsw.co.in/en/products/injectionmoulding

vi) http://www.opm.gov/fedclass/fws3869.pdf

* * *

COURSE ID: ME
Course Name : STRENGTH OF MATERIALS
Course Code : MEG305
Course Abbreviation : GSOM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : CCG110

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Exam (External)	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks for each practical ii) One PST of 25 marks iii) 25 marks for microproject	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E - External Examination

2. RATIONALE:

This course is a continuation of Applied Mechanics. It deals with mechanics of deformable bodies. Effects of various forces or force systems on the material can be studied and deformations and stresses can be determined using the principles. Mechanical properties of engineering materials are also studied in this course which help in selecting suitability of material for various engineering applications. It lays a foundation for the course Machine Design and strength of materials used in industries.

3. COMPETENCY:

a) Cognitive : Applying principles of strength of materials to engineering problems to estimate stresses and mechanical properties

b) Psychomotor: i) Operating testing machines ii) plotting graphs and diagrams

c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality v) aesthetic presentation

4. COURSE OUTCOMES:

MEG305.1 Analysis of basic mechanical actions and behavior of materials under the action of forces.

MEG305.2 Determine moment of inertia of plane composite sections.

MEG305.3 Solve problems on shear force and bending moments in beams and shear - bending stresses of beams

MEG305.4 Solve problems on direct& bending stresses

MEG305.5 Determine principal stresses in structural components

MEG305.6 Solve problems on torsion for circular sections.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium),: Substantial (High), "-" : no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools , experimentation and Testing	PO 5 Engineering Practices for Society , Sustainability and Environment	PO 6 Project management	PO 7 Life long learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	2	3	3	2	-	-	2	2	1
MEG305-1	2	2	1	1	-	-	2	2	1
MEG305-2	2	2	1	-	-	-	2	1	1
MEG305-3	3	2	2	1	-	-	2	2	1
MEG305-4	2	2	2	1	-	-	2	2	1
MEG305-5	2	2	2	1	-	-	2	2	1
MEG305-6	2	2	2	1	-	-	2	2	1

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the Laboratory Manual developed by the Institute in practical sessions of batches of about 22 students:

Sr. No.	Laboratory experiments (Any eight from 1 to 11, & 12 compulsory)	Competencies to be developed	Course Outcome
1	Study of the universal testing machine.	Identify different parts of machine and their actions.	MEG305-1
2	Tension test on mild steel bar.	Determine mechanical properties of mild steel.	
3	Tension test on HYSD steel bar.	Determine mechanical properties of HYSD steel.	
4	Compression test on metals.	Interpret failure pattern (behavior) of metal under compression action	
5	Izod Impact test on metals.	Discriminate various materials on the basis of strain energy absorbed.	

6	Charpy Impact test on metals.	Discriminate various materials on the basis of strain energy absorbed.	
7	Deflection and Flexural test on mild steel	Determine deflection of material. under loading.	MEG305-3
8	Shear test on metals	Discriminate failure under single and double shear action.	MEG305-1
9	Brinell Hardness test on metals	Interpret BHN of different metals	
10	Rockwell hardness test on metal	Interpret RHN of different metals.	
11	Torsion test on mild steel	Determine torsional strength of steel.	MEG305-6
12	Shear force and bending moment problems	Any four problems	MEG305-4

b. Micro Projects: (one microproject to the group of 4/5 students)

i) Survey of machines: observe various machines for structural actions mentioned in the theory syllabus and prepare a report with their photographs.
ii) Collect IS standards for methods of testing and specifications of machines/materials/specimens etc.
iii) Collect information from industry for material used for various types of machines available in market and prepare report.
iv) Presentation for different testing methods used in industry
v) Comparison of different material for different properties of metals and to prepare report/chart.
vi) collect information for machine components subjected to direct & bending stress
vii) To prepare models of single and double shear conditions.
viii) calculation of moment of inertia in excel.
ix) Prepare SFD and BMD in excel.
x) software-based exercises like Ansys or other FEM softwares.
xi) Collect information of use of principal stresses and prepare presentation
xii) or any other microprojects suggested by the teacher.

B) INDUSTRIAL EXPOSURE:

i) Quality control of material by above experiments
ii) Through Microprojects

C) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG305-1 Analysis of basic mechanical actions and behavior of materials under the action of forces.			
1	**AXIAL TENSION AND COMPRESSION** 1.1 Basic mechanical actions: axial tension, axial compression, flexure, shear, torsion. Combination of basic mechanical actions. 1.2 Behavior of ductile and brittle material under tension. 1.3 Definition of axial and eccentric loading. Definition of uni-axial, bi-axial and tri-axial loading. Diagrams showing these loadings. 1.4 Examples of components in axial tension and compression. 1.5 Numerical problems on deformations of uni-axial members made up of i) single material ii) combination of two or more materials along the length (compound members). Practical examples. 1.6 Composite sections: Stresses and elongation under uni-axial loading. Modular ratio. 1.7 Lateral strains and deformation. Poisson's ratio. 1.8 Volumetric stress and strain, bulk modulus. 1.9 Shear stresses and shear strains. Modulus of rigidity. 1.10 Relation among elastic constants. 1.11 Temperature stresses in simple member.	**08**	**16**
2	**STRAIN ENERGY** 2.1Definition of strain energy, resilience, proof resilience and modulus of resilience. Strain energy stored due to gradual, sudden and impact loading 2.2 Stresses and elongation due to gradual, sudden and impact loading	**04**	**06**
MEG305-2 Determine moment of inertia of plane composite sections.			
3	**MOMENT OF INERTIA** 3.1 Definition of moment of inertia. Moment of inertia of regular plane figures square rectangle triangle circle 3.2 Parallel axes theorem and perpendicular axes theorem 3.3 Moment of Inertia of composite figures. Radius of gyration	**06**	**10**
MEG305-3 Solve problems on Direct bending stresses in beams.			
4	**DIRECT & BENDING STRESSES IN BEAMS** 4.1 Concept of direct and eccentric loading. Practical examples. 4.2 Stresses in machine components subjected to eccentric loads with eccentricity about only one axis. Core of section	**06**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics	Lectures (Hours)	Theory Evaluation
MEG305-4** Solve **problems on shear force and bending moments and shear -bending stresses in beams			
5	**SHEAR FORCES AND BENDING MOMENTS IN BEAMS** 5.1 Types of beams: simply supported, over-hanging, cantilever, propped cantilever, fixed, continuous. Types of loads: concentrated loads, uniformly distributed loads and uniformly varying loads, couple loads. 5.2 Definition of shear force and bending moment at a section, Sign convention. Relation between shear force and bending moment 5.3 problems on Shear force diagrams and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to above loads. Point of contraflexure.	**08**	**14**
6	**BENDING AND SHEAR STRESSES IN BEAMS.** 6.1 Definition and assumptions in theory of simple bending. 6.2 Tension and compression zones, neutral axis, bending stresses, stress distribution over the section, moment of resistance, section modulus. 6.3 Flexural formula and its application (no derivation) 6.4 Assumptions and shear stress formula and its application. (no derivation) 6.5 Shear stress distribution across different across sections of beam. e.g. rectangular, circular, I section, T section. 6.6 Relation between maximum and average shear stress.	**06**	**10**
MEG305-5 Solve problems on principal planes and stresses			
7	**PRINCIPAL STRESSES AND STRAINS** 7.1 Definition of principal stresses and principal planes. Different states of stresses. Diagrammatic representation. 7.2 Analytical method: Determination of normal and shear stresses on oblique planes of an element subjected to axial stresses and / or shear stresses. Resultant stress and its obliquity. Determination of principal planes, principal stresses, maximum shear stresses and their planes. Planes of maximum obliquity. 7.3 Graphical method: Mohr's circle method to determine the above stresses and planes.	**06**	**08**
MEG305-6 Solve problems on Torsion in shafts			
8	**TORSION IN SHAFTS.** 8.1 Assumptions in theory of torsion. Definition of torsional load, twisting moment, angle of twist. Torsional equation, shear stress distribution across a section of solid and hollow circular shaft.	**04**	**08**

	8.2 Torsional strength of hollow and solid shafts. Saving in weight due to hollow shafts. Power transmitted by shafts. Combined torsion and bending		
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic no.	Name of topic	Distribution of Marks (Cognitive level wise)			Course Outcome	Total Marks
		Remember	Understand	Applica-tion		
1	Axial Tension and Axial Compression	02	02	12	MEG305-1	**16**
2	Strain energy.	02	02	02	MEG305-1	**06**
3	Moment of Inertia.	02	02	06	MEG305-2	**10**
4	Direct & bending Stresses in Beams.	02	02	04	MEG305-3	**08**
5	Shear Forces and Bending Moments in Beams	02	02	10	MEG305-4	**14**
6	Bending and Shear stresses in beam.	02	02	06	MEG305-4	**10**
7	Principal stresses and strains	02	02	04	MEG305-5	**08**
8	Torsion in shaft.	02	02	04	MEG305-6	**08**
	Total	**16**	**16**	**48**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above. Candidates can attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR PRACTICAL WORK AND PRACTICAL EXAM

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per criteria given in *Proforma III*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria given in *Proforma- III*

b) Term-end Oral Examination (External):

Term-end Oral Examination (**External**) shall be conducted as per the *Proforma-III*

Sr. no	Criteria	Marks allotted
1	Understanding of the subject	16
2	Quality and neatness of term work	16
3	Participation	10
4	Result table / calculations / graphs	08
	Total	**50**

9) INSTRUCTIONALSTRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Massive open online courses (MOOCs) can be used to teach various topics

15 to 20% of topics which is simple will be given to students for self-directed learning

10) REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	Timoshenko, S.P. and Young, D.H.	Elements of Strength of Materials	Affiliated East West Press Pvt. Ltd., Delhi
2.	Sunil Deo	Text book on Mechanics of Structures	Nirali Publications
3.	Bhavikatti S.S.	Strength of materials.	Vikas publishing house pvt Ltd.
4.	Khurmi R.S.	Strength of Materials	S. Chand & Co., Delhi
5.	Singer F.L.	Strength of Materials	Harpe Collins Publishers India Delhi
6	S Ramamurtham & Narayan	Strength of materials	Danpat Rai
7	S S Ratan	Strength of materials	Tata McGraw-Hill

b) Websites

i. *en.wikipedia.org/wiki/Structural_mechanics*
ii. http://www.powershow.com/view/15b5baNzRmY/CE_203Structural_Mechanics_powerpoint_ppt_presentation

* * *

COURSE ID: ME

Course Name : MACHINE TOOLS
Course Code : MEG306
Course Abbreviation : GMTL

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	07
Practical	04	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	According to Proforma-III	**80**	**75 E**	**175**

E- External Assessment

2. RATIONALE:

Diploma technician often comes across various types of basic production processes. He / She required to select operate and control processes. He / She also required knowing about various cutting tools, latest improvements in production processes, surface finishing process and plastic processes.

3. COMPETENCY:

Operate various machine tools.

a) Cognitive :Understand the theory of metal cutting and mechanisms of various machine tools.

b) Psychomotor: Perform operations on different machine tools.

c) Affective : Develop **a**ttitude of i) Accuracy ii) Safety iii) Precision

4. COURSE OUTCOMES:

MEG306-1 Select cutting tools materials and trace various mechanisms of machine tools.

MEG306-2 Specify Lathe machine, Drilling machine, Shaping machine, Broaching and Grinding machine.

MEG306-3 Perform various operations on above machine tools.

MEG306-4 Select various super finishing processes.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design /development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering practices for society, sustainability and environment**	**PO 6 Project Management**	**PO 7 Life-long learning**	**PSO 1 Work in mfg& service sector**	**PSO 2 Start entrepreneurial activity**
Competency	1	-	-	3	-	-	-	2	-
MEG306-1	1	-	-	3	-	-	-	2	-
MEG306-2	1	-	-	3	-	-	-	2	-
MEG306-3	1	-	-	3	-	-	-	2	-
MEG306-4	1	-	-	3	-	-	-	2	-
MEG306-5	1	-	-	3	-	-	-	2	-

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

Sr No	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	One job on lathe containing the operations like plain turning, threading, boring, taper turning.	To select speed, feed and tool for various operations like turning, boring, threading etc.	MEG306 - 1-4
2	One job on Shaping/Slotting Machine	To know Shaping/Slotting methods	MEG306 - 1-4
3	One assignment on accessories & attachment – chucks, mandrels, carrier and catch plates rests, face plate and angle plate, grinding attachment used on lathe.	To know about various basic parts of lathe machine and various attachments.	MEG306 - 3
4	One assignment on types of grinding wheels.	To know about various grinding wheels and shapes.	MEG306 - 3
5	Demonstration of center less grinding machine & report writing/ One job on grinding machine.	To develop advance grinding methods.	MEG306 - 3
6	One assignment on cutting tool nomenclature and tool signature of single point cutting tool.	To know theory of metal cutting of single point cutting tools geometry and nomenclature.	MEG306 - 3
7	One assignment on accessories & attachment, work holding & tool holding devices used on milling machine.	To maintain maintenance of machine tools like milling machine.	MEG306 - 1-4

8	One assignment on shapers and slotting machines.	To know the working principle of shapers, planers and slotting machines.	MEG306 - 1-4
9	Assignment on accessories and attachments used on lathe.	To know various parts and attachments of lathe.	MEG306 - 1-4

b. MICROPROJECT

Students should conduct following activity in group of 4-6students and prepare reports of about 5- 10 pages, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each mini-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The student tought to submit mini-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro projects is given here. Similar mini-projects could be added by the concerned faculty:

i) Take any 5 components/ machine parts and identify machining processes required to manufacture it and plan the sequence of operations.
ii) Prepare display board for designation of grinding wheel as per 551-1954
iii) Prepare a report with detail specification of machines available in the institute workshop
iv) Produce different types of keys
v) Produce component on radial drilling machine
vi) Produce components like shaft, pulley etc

B. INDUSTRIAL EXPOSURE:

Sr. No.	Mode of Exposure	Topic
1.	Field visits	Covering theory
2.	Field examples of course application	Term-work assignment

C. THEORY:

SECTION I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome: **MEG306-1** Select cutting tools materials.			
1	**THEORY OF METAL CUTTING** 1.1 Basic concepts of machining, cutting tool 1.2 Cutting tool materials & its properties 1.3 Single point cutting tool & its geometry 1.4 Tool signature 1.5 Tool angles	**08**	**12**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome: **MEG306-1** Select cutting tools materials.			
	1.6 Cutting fluids or coolants: Types, purpose and desirable characteristics 1.7 Formation of chips: Continuous, discontinuous, built-up edge 1.8 Chip breakers 1.9 Cutting tool parameters 1.10 Cutting speeds and feeds		
Course Outcome: **MEG306-1 Trace** mechanism of lathe machine. **MEG306-2 Specify** Lathe Machine.			
2.	**LATHE MACHINE** 2.1 Types of Lathes: Light duty, Medium duty and Heavy duty geared lathe, CNC lathe 2.2 Specifications 2.3 Basic parts and their functions 2.4 Operations – Turning, Parting off, Knurling, Facing, Boring, Drilling, threading, Step turning, Taper turning 2.5 Cutting parameters 2.6 Cutting speed, feed, depth of cut and machining time	**08**	**14**
Course Outcome: **MEG306-1** Trace mechanism of Drilling machine. **MEG306-2** Specify drilling machine.			
3	**DRILLING MACHINES** 3.1 Classification 3.2 Radial drilling machine 3.3 Specifications 3.4 Operations: Drilling, Boring, Counter Boring, Countersinking, Reaming, Spot facing, Tapping, Lapping, Grinding, Trepanning. 3.5 Twist drill nomenclature 3.6 Types of drills 3.7 Cutting Parameters 3.8 Cutting speed, feed, depth of cut and machining Time	**08**	**14**
	Total	**24**	**40**

SECTION II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome: **MEG306-1 Trace** mechanism of Shaping& Slotting Machine. **MEG306-2 Specify** Shaping& Slotting Machine.			
4	**SHAPING& SLOTTING MACHINES** 4.1 Types of: Shapers, Planners, Slotting machines 4.2 Basic parts and their specifications	**06**	**10**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome: **MEG306-1** Select cutting tools materials.			
	4.3 Quick return mechanism of shaping machine 4.4 Cutting speed, Feed, Depth of cut, Machining time of each machine.		
Course Outcome: **MEG306-1 Trace** mechanism of Broaching Machine. **MEG306-2 Specify** Broaching Machine			
5	**BROACHING MACHINES** 5.1 Introduction 5.2 Classification of broaching machine 5.3 Basic parts of vertical broaching machine & their functions 5.4 Broaching methods & operations 5.5 Advantages & limitations of broaching machines	**06**	**08**
Course Outcome: **MEG306 - 1 Trace** mechanism of Grinding Machine. **MEG306 - 2 Specify** Grinding Machine.			
6	**GRINDING** 6.1 Classification of Grinding machines 6.2 Grinding wheel types and shapes 6.3 Tool & cutter grinder 6.4 Designation of grinding wheel as per 551-1954 6.5 Types of abrasive 6.6 Grit, Grade & Structure of grinding wheel	**08**	**12**
Course Outcome: **MEG306-4:** Select various super finishing processes.			
7	**SUPER FINISHING PROCESSES** 7.1 Introduction 7.2 Methods of surface finishing, advantages, limitations & applications of following processes 7.3 Honing Process 7.4 Lapping Process 7.5 Burnishing Process 7.6 Polishing and buffing process	**04**	**10**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Theory of Metal Cutting	04	04	04	MEG306 - 1	12
2	Lathe Machines	04	05	05	MEG306 - 1-3	14
3	Drilling Machines	04	04	06	MEG306 - 1-3	14
4	Shaping, Planning & Slotting Machines	04	04	02	MEG306 - 1-3	10
5	Broaching machines	02	02	04	MEG306 - 1-3	08
6	Grinding Machines	02	04	06	MEG306 - 1-3	12
7	Superfinishing	02	04	04	MEG306 - 4	10
TOTAL		**22**	**27**	**31**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates shall able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	05
	Drawing / drafting skills	05
Affective	Discipline and punctuality	03
	Decency and presentation	02
TOTAL		**25**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria. Final marks of term work shall be awarded as per *Assessment Pro-forma III.*

b) Assessment Criteria for Term-end Practical Examination (External): *Pro-forma III*

Term-end Practical Examination shall be conducted by internal examiner (course teacher) and external examiner (course teacher of different class from the Institute) as per the following criteria.

Item >	Oral	Total
Marks >	50	50

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures
ii) Demonstration during practicals

Teaching and Learning Resources:

i) Chalk board
ii) LCD Projector

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes:

Sr. No.	Author	Title	Publisher
1.	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
2.	B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat rai & Sons
3.	R. K. Jain	Production Technology	Khanna Publication New Delhi
4.	Production Technology	Hindustan Machine Tools (HMT)	Tata Publication

b) Websites:

1) http://nptel.ac.in
2) www.egr.msu.edu/~pkwon/me478
3) www.basicmechanicalengineering.com/lathe~machine~operation~basic:turning.operations
4) www.planomillers.com/drilling.machine.html
5) www.jsw.co.in/en/products/injectionmoulding
6) http://www.opm.gov/fedclass/fws3869.pdf

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COURSE ID: ME

Course Name : THEORY OF MACHINES
Course Code : MEG308
Course Abbreviation : GTOM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Assessment

2. RATIONALE:

Mechanical Engineering Diploma holders are more concern with various mechanisms, and machines in workshops, industries and in practices. The diploma technicians therefore have knowledge of repair, keep maintenance, modify if required the various machines and mechanism. He should able to analyze and identify construction, interpret operation and become expertise in repair and maintenance of various machines and mechanism. This course is a study of different mechanism, their analysis and synthesis, which includes study of motion and forces concerning different part of mechanisms. Also, it makes student's acquaint to study about transmission and transformation of motion, its analysis its and improvement.

3. COMPETENCY:

Use principles of kinematics and dynamics in maintenance of various mechanical equipments

a) Cognitive : Interpret different mechanisms and their applications.

b) Psychomotor: Construct velocity, acceleration diagrams and Cam profile for controlling the motion.

c) Affective : Attitude of i) Analytical Thinking ii) Graphical Solutions iii) Accuracy

4. COURSE OUTCOMES:

MEG308-1- Construct various mechanism and their applications
MEG308-2- Determine velocity and acceleration of different mechanism by Graphical Method
MEG308-3 -Justify role of Flywheel and Governors in Mechanical applications
MEG308-4- Select power transmission devices for different applications.
MEG308-5- Choose brakes and clutches for various applications
MEG308-6- Construct different types of Cam Profiles for given application.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Lifelong learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	2	3	3	2	2	1	2	3	3
MEG308-1	2	1	1	3	3	2	2	2	2
MEG308-2	2	3	3	2	1	2	2	2	2
MEG308-3	3	3	3	2	2	1	2	2	2
MEG308-4	2	3	3	2	2	1	2	3	3
MEG308-5	2	3	3	3	2	3	2	3	3
MEG308-6	3	3	3	2	1	2	1	3	3

6. CONTENT:

A) Continuous Assessment (CA):

Practical Exercises and related skills to be developed:

a) The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No	Laboratory experience	Skills developed	Course Outcome
1	List the mechanisms available in the surrounding; identify its name, links, kinematic pairs and type of kinematics pair, types of inversions.	Observation and collection of information regarding various mechanisms in view of theoretical concepts.	MEG308-1
2	Solve any two problems on velocity & acceleration in mechanism. i) By Relative Velocity Method ii) Klein's Construction	Solving problems by graphical method	MEG308-2
3	Demonstration of Governor	Calculation of Angular Velocity, Radius of rotation and Centrifugal Force	MEG308-3
4	Study of belt, rope and chain drives	Observation, drawing & collection of information regarding various types of drives.	MEG308-4

5	Assignment on gear & gear trains	Understand gear types, terminology and applications	MEG308-4
6	Identify type of clutch mechanism from an automobile and calculate torque, power etc.	Calculate torque and power transmission for identified type of clutch	MEG308-5
7	Identify different types of brakes such as band brake, block brake from different surrounding vehicles and observe their working.	Observation and understanding of working of various brakes in view of theoretical concepts.	MEG308-5
8	Construction of cam profiles with two different follower motions.	Skill required to draw cam profile	MEG308-6

b. Micro-project:

A suggestive list of microprojects is as follows:

i) Prepare working model of any one mechanism using low-cost materials.
ii) Prepare animations of various mechanisms using free software available on internet.
iii) Market survey of belts for collecting specifications.
iv) Field survey to collect information about applications of flywheels and governor.

B) INDUSTRIAL EXPOSURE:

Included in Micro-project

C) THEORY:

SECTION - I

Sr. No	Topics	Teaching (Hours)	Theory Evaluation Marks
Course Outcome **MEG308-1-** Construct various mechanism and their applications			
1.	**FUNDAMENTALS OF MECHANISMS** 1.1 Link, Kinematic link, Types of links, Structure, Difference between machine and Structure 1.2 Kinematics pair and its type, Constrained Motion and its types, Kinematics chain, Mechanism and machines 1.3 Four bar mechanism, its inversions and Characteristics 1.4 Single slider crank chain and its inversions 1.5 Double slider crank chain and its inversions	**08**	**12**
***Course Outcome* MEG308-2:** *Determine velocity and acceleration of different mechanism by Graphical Method*			
2.	**VELOCITY AND ACCELERATION ANALYSIS** 2.1 Absolute and relative motion 2.2 Motion of a link, angular velocity of link 2.3 Determination of velocity of link by relative velocity method 2.4 Acceleration, angular acceleration, Centripetal and tangential acceleration 2.5 Determination of acceleration in simple mechanisms 2.6 Klein's construction to determine velocity and acceleration	**08**	**14**

Course Outcome **MEG308-3** Justify role of Flywheel and Governors in Mechanical applications			
3.	**FLYWHEEL, GOVERNER and BALANCING** 3.1 Flywheel-Introduction to flywheel – need, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C Engine. 3.2 Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. 3.3 Governors- Introduction, types, functions and applications, Terminology of Governors. Comparison of Flywheel and Governor. 3.4 Balancing- Need and types of balancing, Balancing of single rotating mass, balancing of several masses revolving in same plane.	**08**	**14**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome **MEG308-4** Select power transmission devices for different applications.			
4.	**POWER TRANSMISSION** 4.1 Types of drives-Belts, Rope, Chain and Gear and their comparison with applications, advantages and limitations 4.2 Belt Drives: Types, Material, velocity ratio, Angle of lap, Length of belt, Slip and Creep, Ratio of tensions, Initial tension, Centrifugal tension. (Simple Numerical) 4.3 Power transmitted by flat belt drive& V belt drive, Condition for maximum power transmission (Simple Numerical) 4.4 Gears: Types, Materials, Terminology of gears. 4.5 Forms of teeth, cycloidal and involute profile teeth, comparison between them. 4.6 Gear Trains: Types, Velocity ratio (Simple Numerical)	**12**	**16**
Course Outcome **MEG308-5 Choose** brakes and clutches for various applications			
5.	**BRAKE AND CLUTCHES** 5.1 Introduction to Brakes – Types, Functions and Applications. No numerical on brakes. 5.2 Construction and principle of working of i) Shoe brake, ii) Band brake iii) Internal expanding shoe brake iv) Disc Brake. v) Hydraulic Brake 5.3 Braking force, braking torque and power for shoe and band brake.	**06**	**12**

	5.4 Clutches- Introduction to Clutch - Types, Functions and Applications, 5.5 Construction and principle of working of i) Single-plate clutch, ii) Multi-plate clutch, iii) Centrifugal Clutch iv) Cone clutch 5.6 Derivation for torque and power transmission by uniform pressure and uniform wear theory (Simple Numerical)		
Course Outcome **MEG308-6** Construct different types of Cam Profiles for given application.			
6.	**CAMS** 6.1 Introduction to Cam and Followers, Types of cams, types of followers 6.2 Terminology of cams, Applications of cam and followers. 6.3 Different followers Motions and their displacement diagram: Uniform velocity, Simple harmonic motion and Uniform acceleration and retardation 6.4 Construction of cam profile (Knife edge, roller and flat follower)	**06**	**12**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica-tion		
1	Fundamental and types of mechanisms	4	4	4	MEG308-1	12
2	Velocity and acceleration analysis	2	4	8	MEG308-2	14
3	Flywheel, Governor and Balancing	4	4	6	MEG308-3	14
4	Power Transmission	4	6	6	MEG308-4	16
5	Brake and Clutches	4	4	4	MEG308-5	12
6	Cams	4	-	8	MEG308-6	12
Total		22	22	36		**80**

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *ProformaIII.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III.*

b) Term-end Oral Examination (External):

Term-end Oral Examination (External) shall be conducted by internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Sr. no	Criteria	Marks allotted
1	Understanding	10
2	Quality and neatness of term work	05
3	Participation	05
4	Presentation	05
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional strategies:

i) Lectures and discussions.
ii) Laboratory experiences and laboratory interactive sessions.
iii) Time bound assignments.

Teaching and Learning resources, including references:

i) Chalk-board.
ii) Demonstrative kits.
iii) Demonstrative charts.

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publication
01	P. L. Ballaney	Theory of machines	Khanna Publishers, Delhi
02	Thomas Bevan	Theory of machines	Pearson Education, India
03	S.S. Rattan	Theory of machines	Tata McGraw Hill
04	R.S. Khurmi & J.K. Gupta	Theory of machines	S. Chand & co. Ltd.

b) Websites:

1. http://nptel.iitm.ac.in/video.php?subjectId=112104121
2. www.freebookez.com/theory-of-machine-by-r-s-khurmi/
3. http://www.technologystudent.com/gears1/gears7.htm
4. mechatronics2u.blogspot.com/.../theory-of-machines-by-khurmi-e-book.html

* * *

COURSE ID: ME

Course Name : BASIC ELECTRICAL AND ELECTRONICS ENGG.
Course Code : MEG309
Course Abbreviation : GBEE

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	04	06
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	**Practical**	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	(i) 25 marks for each practical (ii) One PST of 25 marks	Term End Theory Exam (03 hours)	Term End Practical Exam (02 hours)	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I-Internal Assessment

2. RATIONALE:

The basics of Electrical and Electronic engineering are in the study of simple preliminary circuits provided with AC and D.C supplies. Students should deal with the electro-magnetic devices work on the principle of magnetism and electromagnetism. This course aims to empower mechanical engineering students with basic knowledge of electricity and its field applications related to industries.

Also, it is therefore necessary for them to apply the principles of electrical and electronics engineering. This Course will make them conversant with electrical and electronic engineering aspects of manufacturing, production, fabrication, automobile and mechanical engineering-based processes in industries.

3. COMPETENCY:

Use Electrical and electronic equipment safely in Mechanical engineering applications.

a) Cognitive : Identify and illustrate the operation of basic electrical and electronics devices.

b) Psychomotor: Maintain and operate simple basic electrical and electronics circuit.

c) Affective : Attitude of i) Identify ii) Draw iii) Operate v)Test

4. COURSE OUTCOMES:

MEG309-1: Use electric and magnetic principles to solve electrical problems.

MEG309-2: Measurement of electrical quantities.

MEG309-3: Use of different electrical machine and transformer in Industry.

MEG309-4: Identify electronic component in electronic circuits

MEG309-5: Identify and handle semiconductor diodes.

MEG309-6: Identify and illustrate use bipolar junction transistor in electronic circuits

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Life - long learning	PSO1 Work in mfg. & service sector	PSO 2 Start entrepreneurial activity
Competency:	3	2	1	1	1	-	2	1	1
MEG309-1	3	2	1	1	1	-	2	1	1
MEG309-2	3	1	1	1	1	-	2	1	1
MEG309-3	3	1	1	1	1	1	2	1	1
MEG309-4	2	-	-	-	-	-	2	1	-
MEG309-5	3	-	-	2	2	2	3	2	2
MEG309-6	3	-	-	2	-	1	2	1	-

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No	Laboratory experience	Skills developed	Course Outcome
1	Verify the relation for current and voltage/s in series resistances	1. Connect the various components as per the circuit diagrams (after reading them) using proper size wires 2. Write the relation for applied voltage and the voltage drops in series resistances circuit.	MEG309-01
2	Verify the relation for current and voltage/s in parallel resistances	1. Connect the various components as per the circuit diagrams (after reading them) using proper size wires 2. Write the relation for current entering the parallel resistance circuit and the individual resistances.	MEG309-01

3	Verify the Faradays law of Electromagnetic Induction	1. Connect the various components as per the circuit diagrams 2. Observe the operation and take the reading.	MEG309-01
4	Measurement of power by using ammeter, voltmeter & wattmeter	1. Connect the various components as per the circuit diagrams (after reading them) using proper size wires 2. Measure Current, Voltage, Power	MEG309-02
5	Verification of relationship between line and phase values of voltage & current in STAR connection.	1. Measure line & phase values of voltage, current. 2. Verify their relationship for voltage & current. Calculate Power	MEG309-02
6	Verification of relationship between line and phase values of voltage & current in DELTA connection	1. Measure line & phase values of voltage, current. 2. Verify their relationship for voltage & current. Calculate Power	MEG309-02
7	Determine transformation ratio of single-phase transformer	1. Connect the various components as per the circuit diagrams (after reading them) using proper size wires. 2. Measure voltages and current 3. Calculate transformation ratio	MEG309-03
8	To reverse the direction of three phase induction motor	1. Connect the various components as per the circuit diagrams (after reading them) using proper size wires. 2. Reverse the connection and observe the rotation.	MEG309-03
9	Identification electronic equipments in basic electronics laboratory	1. Identify different electronic equipments. 2. Operate DMM, power supply, CRO, function generation. Illustrate the use of bread board	MEG309-03
10	Test different types of resistors.	1. Identify different types of resistors 2. Find value of different types of resistors	MEG309-04
11	Test different types of capacitors.	1. Identify different types of capacitors 2. Find value of different types of capacitors	MEG309-04
12	Test different types of inductors.	1. Identify different types of inductors 2. Find value of different types of inductors	MEG309-04
13	Test the performance of PN junction diode	1. Build the circuit as per circuit diagram 2. Record the measured readings in observation table 3. Draw the forward & reverse	MEG309-05
14	Test the performance of zener diode	1. Build the circuit as per circuit diagram 2. Record the measured readings in observation table 3. Draw the forward & reverse characteristics	MEG309-05

15	Test the half wave circuits on breadboard	1. Construct the circuit as per circuit diagram 2. Record the waveform displayed on the oscilloscope according to the setting of VOLT/DIV 3. Record readings measured in observation table	MEG309-05
16	Test the full wave center-tapped circuit on breadboard	1. Construct the circuit as per circuit diagram 2. Record the waveform displayed on the oscilloscope according to the setting of VOLT/DIV 3. Record readings measured in observation table	MEG309-05
17	Test the full wave bridge circuit on breadboard with π-filter	1. Construct the circuit as per circuit diagram 2. Record the waveform displayed on the oscilloscope according to the setting of VOLT/DIV 3. Record readings measured in 4. observation table and calculate ripple factor	MEG309-05
18	Identify transistor configuration	1. Identify the transistor configuration 2. Interpret the circuit working	MEG309-06
19	Test the working of the assembled BJT amplifier in CE mode	1. Construct the circuit as per circuit diagram 2. Record the reading in observation table. 3. Sketch the graph of input & output waveforms.	MEG309-06

b) Micro Project: -

Only one micro project is planned to be undertaken by a student that will be assigned at the beginning of the semester. In first four semester project is group based. In fifth and sixth semester project should be preferably individual to build up the skill and confidence in the students. The Micro project weightage about 25 Marks considered in Assessment Proforma IV. The following suggested list given below for Micro project, concerned faculty can add similar micro projects

1. Collect information of different electrical meters- ammeter, voltmeter, energy meter, wattmeter etc.
2. Survey different machines used in industry for the different purposes
3. Collect information of different electrical heating and furnace
4. Collect information of special motor such as stepper motor, servo motor, universal motor etc.
5. Collect information of different starter used for AC motor.
6. Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
7. Build the center-tapped full wave rectifier with any filter on general PCB
8. Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB
9. Build a circuit to switch on and off the LED by using BJT as switching component.

10. Build Zener as a voltage regulator on general purpose PCB
11. Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output.
12. Build LED blinking circuit using suitable digital circuit
13. Automatic Street light control using LDR

C) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course OutcomeMEG309.1 Use electric and magnetic principles to solve electrical problems.			
1.	**ELECTRIC AND MAGNETIC CIRCUIT** **A] Introduction to elements of electric networks** 1.1. Definitions-Work, power and energy 1.2. Ohm's law 1.3 Equivalent resistance of series, parallel and combination resistance systems. 1.4 Simple numerical problems based on the above. **B] Magnetic:** 1.5 Definition of magnetic flux, MMF, Magnetic force, permeability, reluctance. 1.6 Comparison between electric and magnetic circuit 1.7 Faradays law of electromagnetic induction 1.8 Lenz law	**06**	**08**
*Course Outcome MEG309.2*Measurement of electrical quantities in RLC series circuit.			
2	**MEASURING INSTRUMENTS & ALTERNATING CURRENT CIRCUITS** 2.1 Use of Ammeter, Voltmeter, Wattmeter, Energy meter, Clip–on – Meter& Digital Multi meter 2.2 Generation of EMF, Definition of waveform, cycle, frequency and periodic time. 2.3 Instantaneous value, average value, R.M.S & peak value 2.4 Three-Phase Supply Systems- 2.4.1 Phase sequence and its advantages 2.4.2Voltage, Current and Power relation in STAR connection. (Circuit Diagram and relation statement only) 2.4.3 Voltage, Current and Power Relation in DELTA connection. (Circuit Diagram and relation statement only) 2.4.4 Necessity of Earthing, types- plate and pipe earthing 2.4.5 Safety precautions in Industry.	**12**	**14**

Course Outcome MEG309.3 Use of different electrical machine and transformer in Industry.			
3	**TRANSFORMER AND AC MACHINE** **A] Single Phase Transformer** 4.1 Principle of working 4.2 Construction of single-phase transformer. 4.3 Types of transformers- According construction- core and shell type, according application-power transformer and distribution transformer. 4.3 E.M.F. equation statement (No derivation) 4.4 Definition -Transformation ratio, Efficiency and Regulation **B] Electrical Motors: A.C. Motors** 4.6 Basic Principle of three phase induction motor 4.7 Construction of three phase induction motor (Squirrel cage and Slip ring induction rotor) 4.8 Reversal of rotation 4.9 Application of Squirrel cage and Slip ring induction motor 4.10 Need of starter, DOL starter 4.11 Construction of single phase induction motor 4.12 Working of single phase induction motor 4.13 Types of Single phase AC motor- split phase, capacitor start, capacitor start capacitor run (Only diagram and constructional features) and its applications	**[4]** **[10]**	**[8]** [10]
	Total	**32**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome MEG309.4 Identify electronic component in electronic circuits			
4	**ELECTRONICS COMPONENTS AND SIGNALS** 4.0 Components-discrete, non-discrete, Active, passive 4.1 Resistor: 4.1.1 Working Principle of Resistor 4.1.2 General Symbol, Unit 4.1.3Types of resistors (No description) 4.1.4 Resistors general specifications-Maximum voltage rating, power rating, temperature coefficient, tolerance, ohmic range, operating Temperature 4.1.5 Resistor colour coding with three, four, five Bands 4.1.6 Applications 4.2 Capacitor 4.2.1 General Symbol, Unit	**08**	**10**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	4.2.2 Working Principle of capacitor 4.2.3 Capacitors specification: -capacitor working voltage, Capacitive Reactance 4.2.4 Classification of capacitors (No description) 4.2.5 Color code of capacitor 4.2.6 Applications 4.3 Inductor 4.3.1 General Symbol, Unit 4.3.2 Inductor specifications –self-inductance, mutual inductance 4.3.3 Types of inductors (No description) 4.3.4 Colour Coding of capacitor 4.3.4 Applications 4.5 Signals: waveform (sinusoidal triangular and square), time and frequency domain representation, amplitude, frequency, phase, wavelength. 4.6 Integrated Circuits – Concept of IC, Advantages & disadvantages of ICs 4.7 Classification of IC's, Linear and Digital IC's and its examples,		
Course Outcome MEG309.5 Identify and handle semiconductor diodes.			
5	**DIODE AND APPLICATIONS** 5.0 Conductor, Insulator, semiconductor 5.0.1 Band theory 5.0.2 Intrinsic semiconductor: Si, Ge 5.0.3 Doping 5.0.4 Extrinsic semiconductor: P type, N type 5.1 P.N. junction diode – Ge & Si 5.1.1 Constructional features. 5.1.2 Operating principle. 5.1.3 Characteristics. 5.1.4 Applications. 5.2 Zener diode 5.2.1 Constructional features. 5.2.2 Operating principles. 5.2.3 Characteristics 5.2.4 Applications: Zener as voltage regulator 5.3 Rectifiers: 5.3.1 Definition: Rectification, rectifier 5.3.2 Need of rectification 5.3.3 Classification of rectifier 5.4 Half wave rectifier and full wave rectifier (Center-tapped and bridge) 5.4.1 Circuit diagram and waveforms 5.4.2 Operation	**14**	**16**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	5.4.3 Performance parameter: Ripple factor, Rectifier efficiency, Peak Inverse Voltage 5.4.4 Comparison of rectifier 5.5 Filter – 5.5.1 Need of filter 5.5.2 Types of filters- Shunt capacitor, Series inductor, LC Filter and CLC filter 5.5.3 Operation of each filter w.r.t. full wave bridge Rectifier only 5.6 Comparison of filters		
Course Outcome MEG309.5 Identify and illustrate use bipolar junction transistor in electronic circuits			
6	**BIPOLAR JUNCTION TRANSISTOR** 6.1 BJT-. Types, symbols 6.2 Construction of BJT. 6.3 Operating principles of NPN & PNP Transistor 6.4 Transistor configurations & Modes of operation 6.5 Input and Output characteristics: CE, CB, and configurations. 6.6 Operating regions: Cut-off, saturation and Active. 6.7 Transistor parameters: CB gain α CE gain β, input resistance output resistance, relation between (α) and (β) 6.8 Transistor as switch and amplifier. 6.9 Applications of transistor 6.10 Need of Transistor Biasing 6.10.1Types of biasing (only types, no description) 6.11 Single stage amplifier 6.11.1 Circuit Diagram 3.11.2 Working (Function of each component) 3.11.3 Applications	**10**	**14**
	Total	**32**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica-tion		
1	Electric and Magnetic Circuit	2	4	2	MEG309-1	08
2	Measuring Instruments & Alternating Current Circuits	4	4	6	MEG309-2	14
3	Transformer and AC Machine	4	8	6	MEG309-3	18
4	Electronics Components and signals	2	4	4	MEG309-4	10
5	Diode and Applications	2	6	8	MEG309-5	16
6	Bipolar Junction Transistor	2	4	8	MEG309-6	14
TOTAL		16	30	34		80

8. CONTINUOUS ASSESSMENT CRITERIA:

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria given in *Proforma-IV*

b) Term-end Practical Examination (Internal):

Term-end Practical Examination (Internal) shall be conducted as per the following criteria:

Sr. No.	Criteria	Marks allotted
1	Preparedness for oral	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result table / calculations / graphs	5
5	Safety / use of proper tools	5
	Total	**25**

Final Assessment of Practical Examination shall be done as per *Proforma-IV*

9. INSTRUCTIONALSTRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publication
01	Edward Hughes	Electrical Technology	Hilly Brown Smith
02	V. N. Mittal	Basic Electrical Engineering	CBS, Delhi
03	B. L. Theraja	Electrical technology	S. Chand and Company, Delhi
04	V. K. Mehta	Fundamentals of Electrical Engineering	S. Chand and Company, Delhi
05	R.S.Sedha	A text book of Applied Electronics	S. Chand
06	G. K. Mithal	Applied Electronics	Khanna Publication
07	A. Motershed	Electronics Devices & Circuits	PHI Publication
08	Malvino and Leach	Digital Principles and Applications:	McGraw Hill
09	Bell, Devid	Fundamental of Electronics Devices and circuits	Oxford University

b) Websites:

i) www.ece.rice.edu
ii) igs.nigc.ir/STANDS/BOOK/Electrical-Eng-HB.pdf
iii) www.electrical 4u.com
iv) www.nptel.iitm.ac.in
v) www.learningaboutelectronics.com
vi) www.futurlec.com
vii) www.bis.org.in
viii) www.electrical4u.com
ix) www.cadsoft.io
x) www.electronics-tutorials.com

* * *

COURSE ID: ME

Course Name : ENGINEERING METALLURGY AND MATERIALS
Course Code : MEG310
Course Abbreviation : GEMM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	1. 25 marks for each practical 2. One PST of 25 marks	Term End Theory Exam (03 hours)	Term End Practical Exam (02 hours)	
Marks	**20**	**--**	**80**	**50 I**	**150**

I- Internal Assessment

2. RATIONALE:

Mechanical Engineering students always come across with the selection of material as per requirement. It requires the knowledge of properties and composition of material. This subject deals with the solidification of metals and alloys, equilibrium diagrams and their applications. It covers metallurgical aspects of metals and alloys such as micro and macroscopic examination of metals and alloys. The subject includes study of iron-iron carbon equilibrium diagrams, ferrous and non ferrous metals, TTT diagram, various heat treatment processes and important non-destructive testing methods.

3. COMPETENCY:

Select materials as per requirement

a) Cognitive : Classify various materials & heat treatment processes.
b) Psychomotor : i) Micro and macro testing of materials ii) Specimen preparation
c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality v) aesthetic presentation

4. COURSE OUTCOMES:

MEG310.1 Demonstrate the structure, properties, grades/designation of ferrous metals.
MEG310.2 Interpret Iron-Iron-carbide (Fe-Fe_3C) equilibrium diagram.
MEG310.3 Select various heat treatment processes.
MEG310.4 Select non-ferrous metals and non-metallic materials.
MEG310.5 Choose appropriate non-destructive test for testing of material.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-: no correlation**]**

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life- long learning	PSO1 Work in mfg. & service sector	PSO 2 Start entrepreneurial activity
Competency	3	3	-	3	1	-	1	1	2
MEG310.1	3	3	-	3	-	-	-	1	2
MEG310.2	3	3	-	3	1	-	-	1	2
MEG310.3	3	3	3	3	2	-	-	1	2
MEG310.4	3	2	2	3	1	-	-	1	2
MEG310.5	3	2	2	3	2	-	-	1	2

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Term Work as detailed in the *Laboratory Manual* developed by the department in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Use Metallurgical Microscope for microscopic examination.	Using the microscope Adjusting the focal length	***MEG310.1***
2	Prepare Specimen using ASTM standards.	Polishing with polish papers Using double disc polishing machine Etching with etchants	***MEG310.1***
3	Identify the Microstructure of the given Carbon Steel specimen (Any 2) using Metallurgical Microscope.	Identification of microstructure of Carbon steel	***MEG310.2***
4	Identify the Microstructure of the given Alloy Steel specimen (Any 2) using Metallurgical Microscope.	Identification of microstructure of Alloy steel	***MEG310.2***
5	Identify the Microstructure of the given Grey and Nodular Cast Iron specimen using Metallurgical Microscope.	Identification of microstructure of Grey and Nodular iron	***MEG310.2***
6	Identify the Microstructure of the given White and Malleable Cast Iron specimen using Metallurgical Microscope.	Identification of microstructure of White and Malleable Cast iron	***MEG310.2***
7	Perform Annealing and normalizing of the given steel sample and identify changes in properties.	Carry out annealing and normalizing Selecting temperatures and time using diagram Identify changes in microstructures	***MEG310.3***

8	Perform hardening process of the given steel sample and measure the change in hardness using hardness tester.	Carry out hardening Selecting temperatures and time using diagram Identify changes in microstructures Hardness testing	***MEG310.3***
9	Identify the Microstructure of the given Non-ferrous metal specimen (Any 2) using Metallurgical Microscope.	Identification of microstructure of Non-ferrous metals	***MEG310.4***
10	Detect surface flaws of the given component using penetrant test and Magnetic particle inspection method.	Detecting surface flaws using penetrant and Magnetic particle test	***MEG310.5***

b) Micro-project:

One Miniproject in group of 4 students is required to be completed in a semester. The project will be selected by group and course in charge will finalize it. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

i) Preparation of model for various lattice structures.
ii) Making ready samples of Cast iron, Steel etc.
iii) Making ready samples of various non ferrous metals.

B) INDUSTRIAL EXPOSURE:

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above-mentioned laboratory/field-based experiences:

i) Follow safe practices
ii) Practice good housekeeping
iii) Practice energy conservation
iv) Maintain tools and equipment
v) Follow ethical practices

C. THEORY

Section I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG310.1*Demonstratethe structure, properties, grades /designation of ferrous metals*			
1	**STRUCTURE OF METALS AND ALLOYS** 1.1 Need and Scope of Metallurgy 1.2 Crystal Structures of Metals: Space Lattice, Unit Cell 1.3 Types of Crystal Systems, Common Crystal Structure- BCC, FCC, HCP, Packing Factor 1.4 Mechanism of Crystallization-Nuclei formation and Crystal Growth, Dendritic Structures 1.5 Structures of alloys: Solid Solution-Types, Hume Rothery's rules 1.6 Imperfection of Crystals: Types: Point, Line, Surface	**08**	**12**
MEG310.2 *Interpret Iron-Iron carbide (Fe-Fe_3C) equilibrium diagram.*			
2.	**EQUILIBRIUM DIAGRAMS** 2.1 Cooling Curves of Metals and alloys 2.2 Construction of Binary Equilibrium diagram 2.3 Phase Rule, Lever Arm Principle 2.4 Types of Equilibrium diagram - Isomorphous, Eutectic, Partial Soluble system 2.5 Reaction in Binary System –Eutectic, Peritectic, Eutectoid and Peritectoid	**06**	**10**
MEG310.1*Demonstratethe structure, properties, grades /designation of ferrous metals*			
3	**FERROUS METALS** 3.1 Polymorphism and Allotropy 3.2 Allotropic transformation of pure iron 3.3 Iron-Iron Carbide Equilibrium Diagram- Peritectic, Eutectic and Eutectoid reaction 3.4 Slow cooling of steel: Microstructures of slowly cooled carbon steels 3.5 Effect of Alloying elements on Fe-C diagram 3.6 Selection of material, classification of ferrous metal 3.7 Cast Iron – Types, Properties and applications 3.8 Steel - Plain Carbon steel, Stainless steel, Heat Resisting steel, High Speed steel (HSS) 3.9 Standard specification-Designation and coding methods according to BIS, ASME, EN, DIN, JIS for plain & alloy steel and cast iron.	**10**	**18**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG310.3*Select various heat treatment processes*			
4	**HEAT TREATMENT** 4.1 Purpose and importance of heat treatment. 4.2 Isothermal transformation of Austenite. 4.3 TTT diagram: Significance and construction of TTT diagram for eutectoid steel. 4.4 Introduction to Pearlitic, Bainitic and Martensitic Transformation. 4.5 Different heat treatments processes – (Microstructure changes, advantages, limitations and applications) a. Annealing. b. Normalizing. c. Hardening and Hardenability d. Tempering e. Austempering and Martempering f. Case Hardening Treatments – Carburizing, Nitriding, Cyaniding, Carbonitriding g. Surface Hardening Treatment - Flame Hardening and Induction Hardening	**12**	**18**
MEG310.4 *Select non-ferrous metals and non-metallic materials*			
5	**NON-FERROUS METALS, ALLOYS, NON-METALLIC MATERIALS** **5.1 Non-Ferrous Metals, Alloys (Composition, properties and applications)** a. Copper and its alloys-Brasses and Bronzes b. Aluminum and its alloys c. Magnesium and its alloys d. Bearing Alloys e. Super alloys f. Shape Memory alloys g. Titanium alloys **5.2 Non-metallic materials (Properties and applications)** a. Polymeric Materials - types, characteristics. b. Properties and uses of Thermoplastics, Thermosetting Plastics. c. Characteristics and uses of ABS, Acrylics. Nylons and Vinyls, Epoxides, Melamines and Bakelites d. Rubbers: Neoprene, Butadiene, Buna & Silicons e. Composite Materials - Laminated and Fiber reinforced materials f. Advanced Engineering Materials - Nano materials and smart materials.	**08**	**14**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG310.5 Choose appropriate non-destructive test for testing of material			
6	**NON-DESTRUCTIVE TESTING OF MATERIALS** 6.1 Introduction, Scope, Importance, Working principle, Advantages, Applications and Limitations of - a. Radiography b. Magna Flux test. c. Penetrant test d. Ultrasonic test e. Eddy current test	**04**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Structure of Metals and Alloys	02	04	06	MEG310.1	**12**
2	Equilibrium Diagrams	02	04	04	MEG310.2	**10**
3	Ferrous Metals	04	06	08	MEG310.1	**18**
4	Heat Treatment	04	06	08	MEG310.3	**18**
5	Non-Ferrous Metals, Alloys, Non-metallic materials	04	04	06	MEG310.4	**14**
6	Non-destructive Testing of Materials	02	02	04	MEG310.5	**08**
TOTAL		**18**	**26**	**36**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following criteria:

The average of all the practical marks will be considered as marks out of 25 as per Assessment Pro-forma IV.

ii) **Progressive Skill Test:**

One mid-term Progressive Skill Test of 25 marks shall be conducted.

Final marks of term work shall be awarded as per Assessment Pro-forma IV.

b) Term-end Practical Examination (Internal):

Term-end Practical Examination (Internal) shall be conducted as per the following criteria and marks to be added in Proforma-IV:

Sr. No.	Criteria	Marks allotted
1	Preparedness for oral	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result table / calculations / graphs	5
5	Safety / use of proper tools	5
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Item Bank

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	Introduction to Physical Metallurgy	S.H. Avner	Tata McGraw Hill Education ISBN 978-00-746-3006-8
2.	Material Science and metallurgy	V. D. Kodgire	Everest publishing House ISBN 81 86314 008
3.	Engineering Material	C. P. Sharma	PHI publication ISBN 978-81-203-2448-0
4.	Engineering Materials	B. K. Agrawal	Tata Mcgraw Hill ISBN 978-00-745-1505-1
5.	Material Science and metallurgy	O. P. Khanna	Dhanpat Rai and sons ISBN 978-81-899-2831-5
6	Material Science for Polytechnic	R. K. Rajput	S K Katariya and sons. ISBN 81-85749-10-8

b) Websites:

i) http://vimeo.com/32224002
ii) www.substech.com/dokuwiki/doku.php?id=iron-carbon_phase_diagram
iii) www-g.eng.cam.ac.uk/mmg/teaching/typd/
iv) www.ironcarbondiagram.com/
v) uk.ask.com/web?q=Who+Discovered+Carbon%3Fandqsrc=14097ando=41647924andl=dir
vi) www.youtube.com/watch?v=cN5YH0iEvTo
vii) www.youtube.com/watch?v=m9l1tVXyFp8
viii) www.sakshat.ac.in/

* * *

COURSE ID: ME

Course Name : ENGINEERING METROLOGY
Course Code : MEG314
Course Abbreviation : GEME

1. **TEACHING AND EVALUATION SCHEME:**

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I- Internal Assessment

2. RATIONALE:

The mechanical Engineering technician often come across measuring different parameters of machined components and the appropriate fitments of interchangeable components in the assemblies. For the above purpose he/she is also required to analyze the quantitative determination of physical magnitude and ensure the control of quality. During previous semesters different systems of measurement and their units etc have been introduced in the subject, basic physics. The different methods and instruments which can be used for linear and angular measurements, geometrical parameters (like surface finish, Square ness, Parallelism, Roundness etc....) and the use of gauges and system of limits, Fits, Tolerances etc. are often required to be dealt in detail by diploma technician on the shop floor. He/she is also required to analyze, Interpret and present the data collected, graphically & statistically for ensuring the quality. The knowledge of the subject also forms the basis for the design of mechanical measurements systems, design & drawing of mechanical components.

3. COMPETENCY:

Use various Metrological Instruments.

a) Cognitive : Interpret terminology of various measuring instruments.

b) Psychomotor: Measure dimensions of components by selecting proper measuring instrument.

c) Affective : Develop attitude towards analytical thinking, precision, accuracy, Selection, Safety, care and Precaution of measuring instrument

4. COURSE OUTCOMES:

MEG314.1- Define the terms related to Metrology.
MEG314.2- Select appropriate measuring instrument.
MEG314.3- Select technique to determine dimensions of components.
MEG314.4- Measure and compare the dimensions of given component using instruments and gauges.
MEG314.5- Interpret various terms related to measuring instruments & components.
MEG314.6- Use Slip gauges to calibrate measuring instruments.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Work in mfg. & service sector	PSO 2 Start entrepreneurial activity
Competency	-	3	3	-	-	-	-	3	-
MEG314.1	-	1	2	-	-	-	-	3	-
MEG314.2	-	1	1	-	-	-	-	3	-
MEG314.3	-	3	2	-	-	-	-	3	-
MEG314.4	-	3	2	-	-	-	-	3	-
MEG314.5	-	3	2	-	-	-	-	3	-
MEG314.6	-	3	2	-	-	-	-	3	-

6. CONTENT:

A. Practical Exercises and related skills to be developed:

a. The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students: The following practical exercises shall be conducted as Term Work

Sr. No	Laboratory experience	Skills developed	Course Outcome
1	Linear measuring instruments	Take measurement with Linear measuring instruments	MEG314-2 MEG314-4
2	Use of slip gauges	measurement with slip gauges	MEG314-4,
3	Use of mechanical comparators.	Use of mechanical comparators	MEG314-4,
4	Screw thread measurement	To make Screw thread measurement	MEG314-4, MEG314-5
5	Study of CMM	To study working of CMM for measurement.	MEG314-4, MEG314-5
6	Surface roughness measurement.	Measurement of Surface roughness.	MEG314-5
7	Demo on Gear parameters Measurement.	Understanding of gear parameters	MEG314-4
8	Angle measurement by sine bar and slip gauges.	Use of sine bar and slip gauges	MEG314-3, MEG314-5

9	Calibration	Calibration of vernier caliper, micrometer, dial gauge.	MEG314-4, MEG314-5

b. Micro-project:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

1. Prepare chart of Pneumatic comparator
2. Prepare chart of terminology used in screw thread
3. prepare the wooden prototype of Parkinson Gear tester

B) INDUSTRIAL EXPOSURE:

Included in Micro-project

C. THEORY:

SECTION-I

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEG314-***1****Define the terms related to Metrology.*			
1.	**INTRODUCTION TO METROLOGY** 1.1 Metrology Basics, Definition of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology, Need of inspection, Precision, Accuracy, Sensitivity, Readability, Calibration, Traceability, Reproducibility. 1.2 Sources Of errors, Factors affecting accuracy, Selection of instrument, Precautions while using an instrument for getting higher precision and accuracy. Concept of least count	**06**	**10**
Course Outcome MEG314.***4-*** *Measure and compare the dimensions of given component using instruments and gauges.* MEG314.**2-** *Select appropriate measuring instrument.*			
2.	**STANDARDS AND COMPARATORS** 2.1 Definition and introduction to line standard end standard, Wavelength standard, Slip gauge and its accessories, Length bars. 2.2 Definition, Requirement of good comparator, Classification, use of comparators, Working principle of comparators, Dial indicator, Sigma comparator, Pneumatic comparator, Electrical, Electronic, Relative advantages and disadvantages	**06**	**10**

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEG314**-5** *Interpret various terms related to measuring instruments& component*			
3.	**LIMITS, FITS, TOLERANCES & GAUGES** 3.1 Concept of Limits, Fits, And Tolerances, Selective Assembly, Interchangeability. 3.2 Hole And Shaft Basis System, Taylor's Principle, Design of Plug, Ring Gauges. 3.3 IS919-1993 (Limits, Fits & Tolerances, Gauges IS 3477-1973. concept of multi gauging and inspection	**06**	**12**
Course Outcome MEG314**.4-** *Measure and compare the dimensions of given component using instruments and gauges.*			
4.	**ADVANCES IN METROLOGY** 4.1 CMM (Coordinate measuring machine)- Introduction, Definition, Various Parts of CMM, Types of CMM, Probing system, Advantages of CMM. Factors for Selection of CMM, Measurement capabilities, CMM design factors. 4.2 Geometric Dimensioning and Tolerancing (GD&T) – Definition, Purpose, Advantages, Importance, Symbols	**06**	**08**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	Topics/Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEG314**.4-** *Measure and compare the dimensions of given component using instruments and gauges.*			
5	**SCREW THREAD MEASUREMENT** 5.1 ISO grade and fits of thread, Errors in threads, Pitch errors. 5.2 Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch, two wire method. 5.3 Thread gauge micrometer, Working principle of floating Carriage dial micrometer.	**06**	**10**
6	**GEAR MEASUREMENT AND TESTING** 6.1 Analytical and functional inspection, Rolling test, 6.2 Measurement of tooth thickness (constant chord method), gear tooth Vernier. 6.3 Errors in gears such as backlash, runout,	**06**	**10**
7	**MEASUREMENT OF SURFACE FINISH** 7.1 Primary and secondary texture, Sampling length, Lay, terminology as per IS 3143- 1967, direction of lay, Sources of lay and its significance.	**06**	**10**

Sr. No	Topics/Sub-topic	Teaching (Hours)	Theory Evaluation Marks
	7.2 CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, 7.3 Various techniques of qualitative analysis, Working principle of stylus probe type instruments		
Course Outcome MEG314**-5** *Interpret various terms related to measuring instruments& component*			
8	**MEASUREMENT OF ANGLE** 8.1 Introduction of Sine bar, Angle gauges 8.2 simple problems to measure angles by using sine bar, slip gauges, surface plate and dial gauge indicator	**04**	**04**
Course Outcome MEG314**.6-** *Use sine bar and slip gauges to measure angle*			
9	**TESTING AND CALIBRATION OF GAUGES.** 9.1 Introduction, definition of calibration, importance of Calibration of measuring instruments. 9.2 Calibration procedure for general metrological instruments. (Vernier Calliper, Micrometer, Dial Gauges.)	**02**	**06**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Introduction To Metrology	4	4	2	MEG314-1	10
2	Standards And Comparators.	2	4	4	MEG314-1	10
3	Limits, Fits, Tolerance& Gauges	4	4	4	MEG314-4	12
4	Angular Measurement	2	2	4	MEG314-4	8
5	Screw Thread Measurement	2	4	4	MEG314-3	10
6	Gear Measurement And testing	3	3	4	MEG314-4	10
7	Measurement of Surface Finish	4	2	4	MEG314-3	10
8	Measurement of angles	2	2	0	MEG314-3	4
9	Testing And Calibration of Gauges	2	0	4	MEG314-6	6
	Total	25	25	30		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-IV*.

Sr. No.	Criteria	Marks allotted
1	Attendance in regular practical	10
2	Correctness in diagram and experiment writing	10
3	Understanding of Experiment	20
4	Safety measures and Proper handling of devices	10
	Total	**50**

ii) Progressive Skill Test:

One mid-term ***Progressive Skill*** *Test* of **25** marks shall be conducted as per criteria given below, marks to be added in Proforma-IV:

Sr. No.	Criteria	Marks allotted
1	Correctness and understanding	10
2	Preparedness for practical	05
3	Proper Procedure and Workmanship	05
4	Safety measures and Proper handling of devices	05
	Total	**25**

b) Term-end Practical Examination (Internal):

Term-end Practical Examination (Internal) shall be conducted as per the following criteria and marks to be added in Proforma-IV:

Sr. No.	Criteria	Marks allotted
1	Preparedness for oral	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result table / calculations / graphs	5
5	Safety / use of proper tools	5
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Computer
v) Question Bank

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publisher
01	R.K.Jain	Engineering Metrology	Tata McGraw Hill
02	Mahajan	Engineering Metrology	S Chand & Co.
03	J.F.W. Galyer and C. R. Shotbolt	Metrology for Engineers	ELBS
04	K. J. Hume	Engineering Metrology	Kalyani publishers
05	I.C. Gupta	A text book of Engineering metrology	Dhanpat Rai and Sons,
06	M. Adithan and R. Bahn	Metrology Lab. Manual	T.T.T.I. Chandigarh.

b) Websites:

IS/ International Codes: IS 919 – 1993 Recommendation for limits, fits and tolerances

IS 2029 – 1962 Dial gauges.

IS 2103 – 1972 Engineering Square

IS 2909 – 1964 Guide for selection of fits. I S 2921 – 1964 Vernier height gauges

IS 2949 – 1964 V Block. IS 2984 – 1966 Slip gauges.

IS 3139 – 1966 Dimensions for screw threads.

IS 3179 – 1965 Feeler gauges.

IS 3455 – 1966 Tolerances for plain limit gauges.

IS 3477 – 1973 Snap gauges.

IS 6137 – 1971 Plain plug gauges.

IS 3651 – 1976 Vernier Calliper

IS 4218 - Isometric screw threads

IS 4440 – 1967 Slip gauges accessories

IS 5359 – 1969 Sine bars

IS 5402 – 1970 Principle and applications of sine bars

IS 5939 – 1970 Sine angles, sine tables.

i) www.mechanical.in/engineering-**metrology**-
ii) www.nist.gov/iaao/.../SIM-dimensional-**metrology**
iii) www.barringer1.com/mil_files/NASA-**Metrology**.**pdf**
iv) www.pmelforum.com/downloads/met-hdbk.

* * *

COURSE ID: ME

Course Name : COMPUTER AIDED DRAFTING
Course Code : MEG315
Course Abbreviation : GCAD

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	00	04
Practical	04	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (External)	
Details of Evaluation	--	i. 25 marks for each practical ii. One PST of 25 marks	--	As per Proforma-III	
Marks	**--**	As per Proforma-III	**--**	**50 E**	**50**

E-External Assessment

2. RATIONALE:

The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time. To satisfy this need the use of CAD/CAM & automation is inevitable. To satisfy industrial need, diploma engineer should be able to cope with CAD/CAM technology. With this intention this subject is introduced in the curriculum. The prerequisites of this subject have been introduced in earlier subjects such as engineering graphics, engineering drawing & mechanical engineering drawing.

CAD/CAM technology is moving in the direction of greater integration of design activities & manufacturing activities. CAD covers the use of computer to assist creation, modification and analysis of design CAM include the use of computer to plan manage & control the operation in manufacturing

3. COMPETENCY:

Drafting of mechanical engineering drawing by using Auto Cad software.

a) Cognitive : Understand the drawing views, dimensions and selecting drawing commands of AutoCAD software.

b) Psychomotor: Draw detailed drawing of component

c) Affective : Attitude of i) neediness ii) imagination skill

4. COURSE OUTCOMES:

MEG315-1 Understand the basic fundamental of AutoCAD.
MEG315-2 Use drawing and modifier tool bar.
MEG315-3 Draw 2D drawings with different styles of dimensions.
MEG315-4 Plot 2D drawings.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Learner will be able to work in various sectors.	PSO2 Start entrepreneurial activity in the Mechanical Engineering field
Competency	3	3	3	3	3	-	2	3	1
MEG315-1	3	3	3	1	2	-	2	2	1
MEG315-2	3	3	3	1	2	-	1	2	2
MEG315-3	2	2	3	1	2	-	1	2	1
MEG315-4	3	3	3	1	3	-	2	2	1

6. CONTENT:

A. Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No	Laboratory experience	Skills / Competencies to be developed	Course Outcome
1	Using 2D auto CAD, draw orthographic Projection of any two simple components.	Drafting of 2D drawing.	MEG315-1
2	Using 2D auto CAD, draw orthographic Projection of machine components: Coupling and Pulley.	Drafting of 2D drawing.	MEG315-2
3	Using 2D Auto CAD draw anyone of the listed assembly drawing having at least five components: foot step bearing, Plummer block, Four-way tool post, Pipe vice	Drafting assembly drawings and its details.	MEG315-3
4	Using 2D auto CAD draw Industrial 2D drawing	Drafting of 2D industrial drawing.	MEG315-4
5	Using 2D auto CAD draw Industrial 2D drawing and plot	Drafting of 2D industrial drawing.	MEG315-5
6	Using 2D auto CAD draw Industrial 2D drawing and plot	Drafting of 2D industrial drawing.	MEG315-5
7	Using 2D auto CAD draw Industrial 2D drawing and plot	Drafting of 2D industrial drawing.	MEG315-5
8	Using 2D auto CAD draw Industrial 2D drawing and plot	Drafting of 2D industrial drawing.	MEG315-5

b) Micro-project: Using 2D Auto CAD draw anyone of the assembly drawing having at least five components. Form a Group of 4 students in a batch.

B. INDUSTRIAL EXPOSURE:

i) As per practical no. 2 and 3 expert lectures by prominent personalities from industries.
ii) As per practical no. 5 an Industrial visit of students.

C. THEORY:

SECTION-I

Sr. No	Topics / Sub-topics	Practical (Hours)	Theory Evaluation Marks
course outcomes MEG315-1*Understand the basic fundamental of AutoCAD.*			
1	**INTRODUCTION TO AUTO CAD** 1.1 GUI and work places 1.3 File Management: New, Open, Save 1.3 Drawing simple sketches 1.4 Draw tool bar: Line, Circle, Arc, rectangle, Polygon, polyline, Ellipse, Spline Display Control: Zoom, Pan. 1.5 Setting up limits, units, drafting settings. 1.6 Types of Co-ordinate systems: Absolute, Relative, Polar	**16**	**--**
course outcomes MEG315-2 Use drawing and modifier tool bar			
2	**MODIFY AND PROPERTY MANAGEMENT:** 2.1 Modify tool bar: Move, Copy, Rotate, Array, Scale, Mirror, Offset, Trim, Join, Break, Extend, Hatch, Fillet, Chamfer. 2.2 Managing Properties: Line Type, Colour, Line weight, Use of quick properties 2.3 Layer Management 2.4 Match properties	**16**	**--**
	TOTAL	**32**	**N A**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	Topics / Sub-topics	Practical (Hours)	Theory Evaluation Marks
course outcomes MEG315- 3 2D drawings with different styles of dimensions			
03	**ANNOTATIONS:** 3.1 Text: Mtext, Single line text, Style manager, Text editor. 3.2 Dimensioning: Line, Circle, Angle, Arc, Jogged, Ordinate, Arc Length. 3.2 Base line and Continuous dimensioning, Quick dimensioning.	**16**	**--**

Sr. No	Topics / Sub-topics	Practical (Hours)	Theory Evaluation Marks
course outcomes MEG315- 3 2D drawings with different styles of dimensions			
	3.3 Enquiry Commands: Utilities tool bar (Checking Distance, Angle and Area) 3.5 Dimension style manager 3.6 Multileader style manager 3.7 Table, Table style manager		
course outcomes MEG315-4 Plot 2D drawings.			
04	**VIEWS MANAGEMENT:** 4.1 Layout Management: Layouts, Using Templates, V ports 4.2 plotting and plot control	**16**	**--**
	TOTAL	**32**	**N A**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

- N.A.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term Progressive Skill Test of 25 marks shall be conducted. Marks to be added in Proforma-III.

b) Term-end Practical Examination (External):

Term-end Practical Examination (External) shall be conducted by internal-external examiners as per the following assessment criteria and marks to be added in Proforma-III: Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. no	Criteria	Marks allotted
1	Understanding of the subject	16
2	Quality and neatness of term work	16
3	Participation	10
4	Result table / calculations / graphs	08
	Total	**50**

9. INDUSTRIAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions
ii) Classroom practices
iii) Laboratory experiences and laboratory interactive sessions
iv) Experiences and discussions through industrial visits
v) Time bound assignments

Teaching and Learning resources:

i) Chalk board
ii) Demonstrative kits
iii) Demonstrative charts
iv) LCD presentations
v) Audio presentations
vi) Item Bank

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Title	Publication
01	P.N. Rao	CAD/CAM Principles and Applications	Tata McGraw-Hill
02	RadhaKrishna P. & Subramanyam	CAD/CAM/CIM	Wiley Eastern Ltd.
03	AutoCAD R-14	David Frey	BPB Publications

b) Websites:

i) www.cadtutor.net/tutorials/autocad/
ii) www.cad-notes.com/contents/autocad-articles
iii) www.auto-cad-tutorial.com

COURSE ID: ME

Course Name :MECHANICAL ENGINEERING MEASUREMENT
Course Code :MEG316
Course Abbreviation :GMEM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) :<*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I – Internal Assessment

2. RATIONALE:

Measurement plays an important role in all branches of engineering. Students needs to familiar with the advanced measurement techniques along with the principles of instruments. The integration of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering is increasing in industrial sector, forming a vital part in the design, manufacture and maintenance of wide range of engineering products, processes and measurement systems. As a consequence, there is a need for a diploma engineers to understand such systems used in measurement and automation.

3. COMPETENCY:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences

a) **Cognitive : -**Identify transducers & sensors to measure variables.
b) Psychomotor: Measure mechanical measurement variables**.**
c) Affective : Attitude of i) Analytical Thinking ii) Accuracy ii) Precision.

4. COURSE OUTCOMES:

MEG316.1- Identify various static & dynamic characteristics of an instrument.
MEG316.2- Use relevant instruments for measuring displacement, force and torque
MEG316.3-Use relevant instruments to measure pressure and temperature
MEG316.4 Use relevant instruments to measure flow rate
MEG316.5- Use relevant instruments to measure speed, strain and vibration
MEG316.6 Use relevant instruments to measure sound, liquid level and humidity

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-: No correlation]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & testing	PO 5 Engineer ing Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency:	2	-	-	3	1	-	1	1	-
MEG316-1	2	-	-	3	1	-	1	1	-
MEG316-2	2	-	-	3	1	-	1	1	-
MEG316-3	2	-	-	3	1	-	1	1	-
MEG316-4	2	-	-	3	1	-	1	1	-
MEG316-5	2	-	-	3	1	-	1	1	-
MEG316-6	2	-	-	3	1	-	1	1	-

6. CONTENT:

A. PRACTICAL WORK

a) Following Practical Exercises and related skills are to be developed and assessed for the attainment of the competency in the students:

Sr No.	Title of Practical Exercise/Practical Outcome	Skills / Competencies to be developed	Course Outcome
1.	Identify contact and non-contact type instruments	Identification of instruments type	MEG316.1
2.	Calibration of LVDT transducer for displacement measurement	Measurement of displacement.	MEG316.2
3.	Use Load cell to measure force on given system	Measurement of force	MEG316.2
4.	Calibration of Bourdon's Pressure gauge	Calibration of pressure measuring device	MEG316.3
5.	Measure pressure by using Piezo- resistive Sensor.	Measurement of Pressure.	MEG316.3
6.	Measure flow of liquid by Rotameter	Measurement of fluid flow.	MEG316.4
7.	Measure flow rate of liquid by Turbine Flowmeter	Measurement of fluid flow.	MEG316.4
8.	Speed measurement by Inductive Pick up.	Measurement of speed of Shaft.	MEG316.5
9.	Speed measurement by Photoelectric Pick up	Measurement of speed of Shaft.	MEG316.5
10.	Calibration of Thermocouple and Temperature measurement.	Measurement of Temperature.	MEG316.3
11.	Strain measurement by Resistive wire strain gauge.	Measurement of strain	MEG316.5
12.	Use sound meter to measure sound level of a given system	Measurement of sound level	MEG316.6

Any 10 experiments from above need to be performed.

b) MICRO PROJECT:

A suggestive list of micro-projects is given here.

1. Predict and test the performance of sensors of various kinds, including strain gates, thermocouples, tachometers, displacement transducers, dynamometers, pressure gauges and transducers.
2. Collect information of flow measuring devices and perform comparative study.
3. Perform comparative study of different displacement measurement devices and sensors.
4. Perform comparative study of various non - contact sensors
5. Visit to automobile workshop and identify the various sensors used in car and prepare report about their location, functions etc.
6. Prepare a list of instruments used for vibration measurement and analysis.
7. Visit a power plant or manufacturing industry and identify situation where the sensors and instruments are used for predictive maintenance and condition monitoring.
8. Visit the market and collect the sensors brochure with their specification and manufacturer

Evaluation shall be of 25 marks and marks should be added in proforma IV

B. INDUSTRIAL EXPOSURE:

S N	Mode of Exposure	Topic
1	Expert Lecture from Industry	Measurement System, sensors and application

C. THEORY:

SECTION-I

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG316.1- Identify various static & dynamic characteristics of an instrument.			
1	**INTRODUCTION TO MEASUREMENT AND CHARACTERISTICS OF MEASURING INSTRUMENTS:** 1.1 Measurement -Methods of measurement, Classification of Instruments 1.2 Generalized measurement system and its functional elements 1.3 Static terms and characteristics: Range, Span, Accuracy, Precision, Reliability, Errors and Correction, Calibration, Hysteresis Dead zone, Drift, Sensitivity, Threshold and Resolution, Linearity, Repeatability and Reproducibility 1.4 Dynamic Characteristics: Speed of response, Measuring Lag, Dynamic Error, Fidelity, Overshoot, Dead Time and Dead Zone 1.5 Zero, First and Second order instruments 1.6 Measurement of Error: Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors, Causes of errors & Remedies.	**08**	**12**

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	1.7 Transducers: Classification,Active and Passive Transducers, Contact and non-contact, Mechanical, Electrical, Analog and Digital Transducers,		
MEG316.2- Use relevant instruments for measuring displacement, force and torque			
2	**DISPLACEMENT, FORCE AND TORQUE MEASUREMENT** 2.1 Sensors: Introduction, need, contact and non-contact type, light, pressure, pneumatic and piezoelectric sensors 2.2 Position measurement: Specification, selection and application of displacement transducer,Potentiometer, Linear Variable Differential Transformer (L.V.D.T.), RVDT, Potentiometer, Digital Optical Encoders 2.3 Force measurement system: Force sensors, Types of Load cell, application 2.4 Torque Measurement: Inline and reaction torque measurement, Torque sensors: construction and working of Slip ring Rotary transformer, Infrared sensor 2.5 Dynamometers: construction and working of transmission and absorption Dynamometer, Hydraulic Dynamometer, Eddy current Dynamometer	**10**	**16**
MEG316.3-Use relevant instruments to measure pressure and temperature			
3	**PRESSURE AND TEMPERATURE MEASUREMENT** 3.1 Pressure Measurement: Low pressure measurement- McLeod Gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge, High Pressure gauge: diaphragm, bellows, Bourdon tube, Electrical-Resistance type, Piezoelectric type 3.2 Temperature Measurement: Classification, non-electrical method- Liquid in Glass thermometer, Pressure, Bimetallic thermometer, Electrical methods: Thermocouple-Elements of thermocouple, Seeback effect, thermo emf measurement, Resistance Thermometer, Thermistor Pyrometer: Radiation and Optical and pyrometer, working, Principle	**06**	**12**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG316.4 *Use relevant instruments to measure flow rate*			
4	**FLOW MEASUREMENT** 4.1 Flow measurement: Classification, selection criteria of flow meter 4.2 Flow meter: application and construction of Orificemeter, Venturimeter, Pitot tube, Dall tube 4.3 Variable area meter: Construction, working and principle of Rotameter, Hot wire Anemometer 4.4 Positive Displacement Flow meter: Construction of Coriolis flowmeter, Oscillating piston flow meter, Rotating vane flow meter 4.5 Ultrasonic flowmeter: Application and construction of Doppler and Transit time ultrasonic flowmeter 4.6 Turbine type flow Meter.	**08**	**12**
MEG316.5- *Use relevant instruments to measure speed, strain and vibration*			
5	**SPEED, STRAIN AND VIBRATION MEASUREMENT** 5.1 Speed Measurement: Working and principle of mechanical Tachometers: Revolution counter and Timer, High speed indicator, Centrifugal force Tachometers, slipping clutch tachometer, Electrical Tachometer: Drag cup, Cumulated capacitor, Tachogenerator. Contactless Electrical Tachometer: Inductive pick up, capacitive pick up, Photoelectric pick up, Stroboscope 5.2 Strain measurement: Types of strain gauge, bonded and unbonded, Gauge Factor, materials of strain gauge, requirement, Selection criteria, installation of strain gauge, Construction of Foil, Semiconductor and wire wound strain gauge Resistance Strain gauge-Principle and working Methods of strain measurement-Axial, bending and torsional, 5.3 Vibration measurement: Elements, Principle and working Accelerometer, velocity Pick up, Introduction to FFT analyzer, working and application	**08**	**16**
MEG316.6 Use relevant instruments to measure sound, liquid level and humidity			
6	**MISCELLANEOUS MEASUREMENT: SOUND, LIQUID LEVEL AND HUMIDITY MEASUREMENT** 6.1 Sound Measurement: Principle of Electro dynamic Microphone and Carbon microphone, Piezoelectric crystals type Microphones 6.2 Liquid level Measurement-Direct and indirect Method. Sight glass Float type, Float and shaft type, Bubbler (Purge) system, Float operated Rheostat type, capacitance level indicator, Gamma ray liquid level sensor	**08**	**12**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	6.3 Humidity Measurement: working and principle of Hair Hygrometer, Sling Psychrometer		
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks			Course Outcome	Total marks
		Knowledge	Comprehension	Application		
1	Introduction to measurement and characteristics of measuring instruments	04	04	04	MEG316.1	12
2	Displacement, force and torque measurement	04	04	08	MEG316.2	16
3	Pressure and temperature measurement	04	04	04	MEG316.3	12
4	Flow measurement	04	04	04	MEG316.4	12
5	Speed, strain and vibration measurement	04	04	08	MEG316.5	16
6	Miscellaneous measurement: sound, liquid level and humidity measurement	04	04	04	MEG316.6	12
	Total >>	**24**	**24**	**32**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical experiment shall be assessed for 25 marks as per following criteria, marks to be added in Proforma-IV

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of report	05
2	Attendance	05
3	Participation	05
4	Understanding of practical	10
	Total	**25**

ii) Progressive Skill Test:

One mid-term Progressive Skill Test of 25 marks shall be conducted, marks to be added in Proforma-IV.

b) Term-end Practical Examination (Internal):

Term-end Practical Examination (Internal) shall be conducted by Internal examiners as per the following assessment criteria and marks to be added in Proforma-IV:

Sr. no	Criteria	Marks allotted
1	Understanding of the subject	05
2	Quality and neatness of work	10
3	Participation	05
4	Result table / calculations / graphs	05
	Total	**25**

Final Assessment of Practical work shall be done as per Pro-forma IV.

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom/Practical Practices

Teaching and Learning resources:

i) Chalk board
ii) LCD
iii) Video presentations
iv) Assignments

10. REFERENCE MATERIAL:

a) Books

Sr. No.	Author	Title	Publisher
1.	Jain R.K	Mechanical & Industrial Measurements	Khanna Publishers
2.	Histand B.H. and Alciatore D.G	Introduction to Mechatronics and Measurement systems	Tata McGraw Hill Publishing
3.	R.S. Sirohi and H.C. Radhakrihna	Mechanical Mechanical iiieasurenaents	New Age international Publishers
4.	A.K. Sawhney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi
5.	Rajput R.K	Mechanical Measurements and Instruments	Kataria and Sons, New Delhi,
6	Narang.C.S	Instrumentation Devices and system	Tata McGraw Hill Publishing

b) Learning Websites

1. https://www.youtube.com/watch?v=sHmjE21Fp9w
2. https://www.youtube.com/watch?v=fmOnrEZ_z6k
3. https://www.youtube.com/watch?v=Mts5Cr_BNCg
4. https://www.youtube.com/watch?v=xFgHG12t-ug
5. https://www.youtube.com/watch?v=dISwdhWCNgw
6. https://www.youtube.com/watch?v=QnOUnoxwf94
7. https://www.youtube.com/watch?v=IIGSmxELsVE
8. https://www.youtube.com/watch?v=4mQ3o1t4Ssg
9. https://www.youtube.com/watch?v=yNryBIe5kEg
10. https://www.youtube.com/watch?v=UkwX5yTclhg
11. https://www.youtube.com/watch?v=zyS9S5vYO6s
12. https://www.youtube.com/watch?v=nFGwQVDXPTE
13. https://www.youtube.com/watch?v=St6kmhfg9mM
14. https://www.youtube.com/watch?v=_TglRnB0KKg
15. https://www.youtube.com/watch?v=nnk0DV5kgMk
16. https://www.youtube.com/watch?v=k2GQVJ4z0kM
17. https://www.youtube.com/watch?v=_3JVLyMv5II
18. https://www.youtube.com/watch?v=NzO2MA4DBtA
19. https://www.youtube.com/watch?v=27dn07nm48o
20. https://www.youtube.com/watch?v=G_9zQqMW9zE
21. https://www.youtube.com/watch?v=xJq3H0-4zgQ
22. https://www.youtube.com/watch?v=zorz6ReaqLA
23. https://www.youtube.com/watch?v=Id4R-2KT9jc
24. https://www.youtube.com/watch?v=sE-r6DV3jjk
25. https://www.youtube.com/watch?v=0du-QU1Q0T4
26. https://www.youtube.com/watch?v=RtPie4DE58E
27. https://www.youtube.com/watch?v=AymStFrB_5M
28. https://www.youtube.com/watch?v=kNxP0oUb6LM

29. https://www.youtube.com/watch?v=bHxEXlIHSHY
30. https://www.youtube.com/watch?v=4xL0N4Svutk
31. https://www.youtube.com/watch?v=A1eznMkOOj0&t=91s
32. https://www.youtube.com/watch?v=4fDqII7ut6Y
33. https://www.youtube.com/watch?v=6OyoljiD7PY
34. https://www.youtube.com/watch?v=vb9OKt5VOm4
35. https://www.youtube.com/watch?v=DbekXH8p24g

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LEVEL - IV
APPLIED TECHNOLOGY COURSES

COURSE ID: ME

Course Name : POWER ENGINEERING
Course Code : MEG401
Course Abbreviation : GPEG

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : MEG302

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	04	06
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E-External Examination

2. RATIONALE:

Engines have vital role in human life. Today's fast lifestyle of human is complimented in great proportion by engine started from steam engine. Presently steam engine are dominated by IC engines. IC engines are used for so many applications in practices, which makes our life handicap without them. Therefore, knowledge of various parts, working, testing maintenance etc. of IC engine, its pollution control and studies is becoming necessary. Next generation of IC engine is gas turbine which also has application in air transport and power generation. Hence knowledge of basic cycle and theoretical aspect involved is necessary. Almost every industry, garages etc. requires an air compressor for various applications hence knowledge of air compressor is essential. Diploma engineer should understand the fundamentals of refrigeration and air- conditioning as there are many industrial applications and also many entrepreneual opportunities in this field.

3. COMPETENCY:

Analyse performance of power producing and power absorbing devices

a) Cognitive: Identify various parts and understand the function of I. C. Engines

b) Psychomotor: Conduct trial on I. C. Engine and air compressor to analyze performance

c) Affective: Attitude of i) Analytic thinking ii) Safety iii) Punctuality

4. COURSE OUTCOMES:

MEE401.1 Define fundamental aspects of Internal Combustion (I.C.) Engine
MEE401.2 Describe the working principles & constriction of different types of I.C. Engines parts and its systems.
MEE401.3 Estimate the performance of I. C. Engines conducting trial.
MEE401.4 Compute various parameters concerning I. C. Engine.
MEE401.5 Describe other work producing and work absorbing contrivances.
MEE401.6 Interpret working and construction of heat engines, Refrigerator & air conditioners.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Lifelong learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	3	3	3	2	2	2	1	3	3
MEG401-1	3	3	-	1	1	-	1	1	1
MEG401-2	2	3	-	1	1	-	1	1	1
MEG401-3	3	2	1	2	2	-	-	2	2
MEG401-4	2	2	1	2	2	1	-	2	2
MEG401-5	2	2	3	3	-	3	2	3	3
MEG401-6	3	3	3	2	-	2	-	3	3

6. CONTENT:

A) **Continuous Assessment (CA):**

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No	Title of Experiment	Skills to be developed	Course Outcome
1	Dismantling and assembling of Petrol / Diesel four stroke Engines with necessary tools.	i) Going through safety measures required. To identify the parts and understand the function & construction of various parts of I. C. Engines. ii) Handling the various tools for dismantling & assembling of I C Engines.	MEG401.1 MEG401.2
2	Demonstration of various engine systems through charts and videos.	i) To observe and understand the construction, working, & function of various engine systems.	MEG401.1 MEG401.2
3	Trial on Petrol and Diesel engine with Heat Balance sheet	i) Going through safety measures required ii) To develop ability to analyze the performance of Engine iii) Tabulating observations and calculations. iv) To plot performance characteristics.	MEG401.3 MEG401.4 MEG401.6

		v) Interpreting results	
4	Visit to Diesel/Petrol engine manufacturing plant.	i) To understand practically working of Diesel/ Petrol engine manufacturing plant. ii) To study the Exhaust gas analysis at engine testing department. iii) Drawing the detail plant layout.	MEG401.1 MEG401.2
5	To conduct a trial on two stage reciprocating air compressors.	i) Going through safety measures required ii) To develop ability to analyze the performance of an air Compressor. iii) Tabulating observations and calculations iv) Interpreting results	MEG401.5 MEG401.6
6	Visit to gas turbine power plant	i) To understand practically working of gas turbine power plant. ii) Drawing the detail layout of gas turbine power plant. iii) Understand the construction & working of various components of gas turbine.	MEG401.5 MEG401.6
7	Trial on Refrigeration Test Rig	i) Going through safety measures required ii) To develop ability to analyze the performance parameters such as power consumed, refrigerating Effect, C.O.P of refrigeration system.	MEG401.5 MEG401.6
8	Trace the flow of refrigerant through various components in window air conditioner/	i) Going through safety measures required ii) To understand practically working of air conditioner	MEG401.5

b) **Micro-project**:

Survey of Various Petrol & diesel engines /compressors//turbines/Cold Storages/Central A C Plants/ Window and split Air conditioners, their capacities, ratings, manufacturers, comparisons, if possible, use and their specifications etc, available in market.

Form a Group of 4 students in a batch. Evaluation shall be of 25 marks & marks should be added in proforma III.

B) INDUSTRIAL EXPOSURE:

Included in experiment no. 1 to 8

C. THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome*MEE401.1** Define fundamental aspects of Internal Combustion (I.C.) Engine ***MEE401.6 Interpret working and construction of heat engines, Refrigerator & air conditioners.			
1	**INTERNAL COMBUSTION ENGINE** 1.1 Classification of IC engines 1.2 Various terms of engines: Bore, Stroke, Dead centers, Compression ratio, Piston displacement, Piston speed 1.3 Power cycles: Otto, Diesel, Dual, Representation on P-V and T-S diagram, Derivation on Otto and Diesel cycle, Simple numerical on Otto and diesel cycle 1.4 Two stroke & four stroke engines: Construction, Working, Comparison, Valve timing diagram and Turning moment diagram 1.5 Brief description of IC engine combustion stages (SI & CI), Scavenging, Pre-ignition, detonation, supercharging, Turbo charging 1.6 List of fuels, Lubricants, Additives and their advantages 1.7 Location, Functioning and Materials of various parts of engine.	**16**	**20**
Course Outcome MEE401.2 Estimate the performance of I. C. Engines conducting trial			
2	**IC ENGINE SYSTEM, TESTING AND POLLUTION CONTROL** 2.1 IC engine system: Construction and Working of Carburetion system (Principle and simple carburetor) MPFI layouts, various sensors. 2.2 Common rail direct fuel injection system (CRDI) controlled by electronic control unit in C. I. engine. Piezoelectric injectors. 2.3 Ignition system (Battery and Magneto) 2.4 Lubrication system (Principles of Lubrication) **Engine Testing:** 2.5 Indicated Power, Brake Power, Mechanical, Thermal, Relative and Volumetric Efficiency, BSFC. (Simple Numerical), Morse test 2.6 Heat Balance sheet and performance curves (Simple Numerical) **Pollution Control:** 2.7 Pollutants in exhaust gases of SI and CI engines and their Environmental Effects 2.8 Pollution measurement 2.9. List of Methods of controlling pollutants as per BS6, EGR (Exhaust Gas Recirculation) lay out, SCR (Selective Catalytic Reduction (**SCR**) system) 2.10. Euro IV & Euro VI Norms.	**16**	**20**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Subtopics	Lectures (Hours)	Theory Evaluation (Marks)
Course OutcomeMEG401.3 Describe other work producing and work absorbing contrivances.			
3	**AIR COMPRESSORS** 3.1 Classification 3.2 Terminology: Pressure ratio, Compressor capacity, Free Air delivered, Swept volume 3.3 Industrial use of compressed air Reciprocating Compressor 3.4 Construction & working of single and two stages reciprocating compressor 3.5 Equation of work done (Simple Numerical) 3.6 Efficiency: Volumetric, Isothermal and Mechanical (Simple Numerical) 3.7 Intercooler, Advantages of multistage compressor Rotary Compressors: 3.8 Construction and working of Roots blower, Vane blower, Screw-Types: Oil Flooded, Oil Free, Centrifugal and Axial flow Compressors (No Numerical) 3.9 Methods of Energy saving in Compressors	**12**	**14**
Course OutcomeMEG401.4 Describe other work producing and work absorbing contrivances			
4	**GAS TURBINES AND JET PROPULSION** **Gas Turbines:** 4.1 Classifications, Applications 4.2 Constant volume and Constant pressure gas turbines: Closed and Open cycle with their comparisons 4.3 Methods to improve thermal efficiency: regeneration, Intercooling, Reheating using T-Ø diagram (No numerical) Jet Propulsion. 4.4 Principles of Turbo jet, Turbo Propeller, 4.5 Rocket propulsion: Solid propellants, Components of liquid propellants and liquid propellant rocket	**08**	**10**
Course Outcome MEE401.5 Interpret working and construction of heat engines, Refrigerator & air conditioner**.** **MEE401.6** Interpret working and construction of heat engines, Refrigerator & air conditioners.			
5	**REFRIGERATION AND AIR- CONDITIONING** **Refrigeration** 5.1 Tons of Refrigeration, coefficient of performance. 5.2 Vapor compression system, Vapor compression refrigeration cycle 5.3 Sub cooling and superheating, representation on p-h, T-S diagrams. 5.4 Basic components of Vapor Compression Cycle, their function and location.	**12**	**16**

	5.5 Applications- Water cooler, Domestic refrigerator, Ice plant & cold storage. Psychometric chart. 5.6 Properties of moist air-DBT, WBT, DPT, Specific humidity and relative humidity, Dalton's law of partial pressure Psychrometric chart & Psychrometric processes-sensible heating/cooling, Air conditioning systems 5.7 Definition and classification of Air conditioning Systems. 5.8 Construction and working of Window air conditioner and split air conditioner. Central air conditioning system		
	Total	**64**	**80**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic no.	**Name of topic**	**Distribution of marks (Cognitive level-wise)**			**Course Outcome**	**Total marks**
		Remember	**Understand**	**Appli-cation**		
1	Internal combustion engine	8	8	4	MEG401-1 MEG401-6	20
2	IC engine system, Testing and Pollution control	8	8	4	MEG401-2	20
3	Air compressors	4	6	4	MEG401-3	14
4	Gas turbines And Jet Propulsion	4	4	2	MEG401-4	10
5	Refrigeration and air conditioning	6	6	4	MEG401-5 MEG401-6	16
	Total	30	32	18		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of report	05
2	Attendance	05
3	Participation	05
4	Understanding of practical	10
	Total	**25**

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III.*

b) Criteria for Term-end Oral Examination (External):

Term-end Oral Examination (External) shall be conducted by Internal, external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Every student has to perform one practical within 2 hours at semester end practical exam which shall be assessed as per following criteria.

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	5
2	Correct figures / diagrams	5
3	Observation tables	5
4	Result Table/ Calculations / Graph	5
5	Safety / use of proper tools	5
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstration
ii) Class Room Practice

Teaching and Learning resources:

i) Chalk board
ii) Video presentation
iii) LCD Presentation

10. REFERENCE MATERIAL:

a) Books

Sr. No.	Author	Title	Publisher
1.	Mathur M.L. & Sharma R. P.	Internal Combustion Engines.	Dhanpatrai Publications Pvt. Ltd. New Delhi.
2.	R. K. Rajput	Tharmal Engineering	Laxmi Publication New Delhi.
3	R. K. Rajput	A text book of internal combustion Engines	Laxmi Publication New Delhi.
4	Pundir B. P.	I .C. Engines Combustion & Emissions	Narosa Publishing House, New Delhi.
5	Khurmi R. S. & Gupte J. K.	Refrigeration & Air Conditioning	S. Chand Publishers – New Delhi
6	V. M. Domkundwar	A Course In Internal Combustion Engines	Dhanpatrai Publications Pvt. Ltd. New Delhi.
7	V. M. Domkundwar	Refrigeration & Air Conditioning Data Book	Dhanpatrai Publications Pvt. Ltd. New Delhi.
8	V. P. Vasandani & D. S. Kumar	Heat Engineering	S. Chand Publishers – New Delhi
9	P.L. Ballaney.	Thermal Engineering	Khanna Publishers, New Delhi.

b) Websites

i) https://www. Jalopnik.com /how-variable-valve-timing-works-500056093.
ii) http://www.araiindia.com/pdf/India_ Emission_Regulation_Booklet.pdf
iii)http://industrial-ebooks.com/CBT_Software/aircompressor- Training91.php

* * *

COURSE ID: ME

Course Name : MACHINE DESIGN
Course Code : MEG402
Course Abbreviation : GMDN

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : MEG305

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	04	06
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Examination

2. RATIONALE:

Machine design consists of application of scientific principles, technical information and imagination for the development of a new or improved mechanical system to perform specific function with maximum efficiency and economy.

This needs students to know load analysis, stress analysis and material properties. They should also be familiar with various mechanical elements, their design method and selection, use of design data book or manufacturers catalogue.

3. COMPETENCY:

Design and draw simple machine elements.

a) Cognitive : Apply design procedure to components under different failure modes
b) Psychomotor: Draw assembly and detailed drawing of designed components
c) Affective : Attitude of i) Analytical thinking ii) safety iii) punctuality iv) Use of design handbook

4. COURSE OUTCOMES:

MEG402-1 Select material and design stress for different types of loading in component
MEG402-2 Analyse the stress and identify failure modes for mechanical components
MEG402-3 Design the power screws and select suitable threaded fasteners for various applications
MEG402-4 Design the power transmission elements like shafts, keys and couplings
MEG402-5 Design simple machine elements like helical spring, spur gear, etc.
MEG402-6 Select standard components like deep groove ball bearings from manufacturer's catalogue.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Lifelong learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	2	3	3	-	1	-	-	2	-
MEG402-1	2	3	3	-	-	-	-	2	-
MEG402-2	2	3	3	-	-	-	-	2	-
MEG402-3	2	3	3	-	-	-	-	2	-
MEG402-4	2	3	3	-	1	-	-	2	-
MEG402-5	2	3	3	-	1	-	-	2	-
MEG402-6	2	3	3	-	1	-	1	2	-

6. CONTENT:

A) Continuous Assessment (CA):

Practical Exercises and related skills to be developed:

a) The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Design of cotter joint or knuckle joint	Students will acquire the skills of selecting the material, selecting the factor of safety, finalizing the permissible stresses by use of design data and with given loading to make a decision regarding the dimensions of the loaded components.	**MEG402-2**
2	Design of power screw		**MEG402-3**
3	Design of threaded connection		**MEG402-3**
4	Design of coupling		**MEG402-4**
5	Design of springs		**MEG402-5**

Each practical exercise shall include design and working drawing of mechanical elements

b) Micro-project: Micro-project should encompass two or more COs. Micro-project consists of design and working drawing of one mechanical part/sub-assembly having elements studied in this course. i.e., i) Power transmission system elements like shafts, keys, coupling, bearing, pulleys, belt drive used in various machine like lathe machine, flour mills, sewing machine etc. ii) Screw jack used in heavy vehicles, cars etc. iii) shaft and spur gear used in agriculture machinery, sugar cane juice machine iv) springs used in shock absorbers, safety valves. Evaluation shall be of 25 marks and marks should be added in Proforma-III

B) INDUSTRIAL EXPOSURE:

Included in experiment no. 2, 3, 4, 5 and Micro-project

C) THEORY:

Section-I

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome MEG402-1: *Select material and design stress for different types of loading in component*			
1	**INTRODUCTION** 1.1 Mechanical engineering design- steps involved in design process 1.2 Aesthetic consideration in design. 1.3 Ergonomic consideration in design. 1.4 Use of standards in design. 1.5 Selection of preferred sizes.	**05**	**06**
Course Outcome MEG402-1: *Select material and design stress for different types of loading in component*			
2	**ENGINEERING MATERIALS** 2.1 Stress: strain diagram of ductile & brittle material. 2.2 Modes of failure 2.3 Factor of safety. 2.4 Selection of materials. 2.5 Casting materials: Gray C.I., white C.I., and malleable C.I. 2.6 Plain carbon steel alloy steel and its BIS designation	**04**	**04**
Course Outcome MEG402-2: *Analyse the stress and identify failure modes for mechanical components*			
3	**DESIGN AGAINST STEADY LOADING** 3.1 Normal stress- strain. 3.2 Shear stress -strain. 3.3 Stress due to bending and torsion moment. 3.4 Principal stresses. 3.5 Theories of failure: max normal stress theory, max shear stress theory, distortion energy theory. 3.6 Design of cotter and knuckle joint.	**09**	**12**
Course Outcome MEG402-3: *Design the power screws and select suitable threaded fasteners for various applications*			
4	**DESISN OF POWER SCREWS** 4.1 Introduction, application, form of threads. 4.2 Torque required to lift and lower the screw and efficiency of screw threads and overall efficiency, self-locking of screw 4.3 Stresses in screws 4.4 Collar frictional torque 4.5 Design of screw jack, C-clamp, vices. (Analytical treatment for square threads only)	**09**	**10**

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome MEG402-3: *Design the power screws and select suitable threaded fasteners for various applications*			
5	**DESIGN OF FASTNERS AND THREADED CONNECTIONS** 5.1 Threaded joints, Advantages of Threaded joint, ISO metric screw threads. 5.2 Basic types of screw fastening and bolts of uniform strength 5.3 Bolted connection- external load in tension, calculation of Resultant bolt load. 5.4 Preload on bolt and its torque requirements. 5.5 Eccentrically loaded bolted joint in shear, Eccentric load perpendicular to axis of bolt	**05**	**08**

Section-II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course Outcome MEG402-1: *Select material and design stress for different types of loading in component*			
6	**DESIGN AGAINST VARIABLE LOADING** 6.1 Fluctuating stresses, fatigue failure, S-N diagram, endurance limit. 6.2 Stress concentration, Stress concentration factors, reduction in stress. 6.3 Concentration effects, notch sensitivity. 6.4 Soderberg and Goodman diagram.	**04**	**04**
***Course Outcome* MEG402-4** *Design the power transmission elements like shafts, keys and couplings*			
7	**DESIGN OF SHAFTS, KEYS, AND COUPLINGS** 7.1 Types of shafts, Shaft materials, Standard sizes 7.2 Design of shaft - strength basis 7.3 Design of shaft - torsional rigidity. 7.4 ASME Code for shaft design 7.5 Types of keys, design of square and flat keys. 7.6 Types of coupling, Design of rigid flange coupling, 7.7 Design of Bushed pin flexible coupling,	**10**	**12**
Course Outcome MEG402-5 *Design simple machine elements like helical spring, spur gear*			
8	**MECHANICAL SPRINGS** 8.1 Types of spring, Applications of springs. 8.2 Terminology of helical springs, Styles of end. 8.3 Helical springs: Stress equation. 8.4 Helical springs: deflection equation. 8.5 Series and parallel connection of springs 8.6 Spring materials. Design of helical springs	**06**	**08**

Course Outcome MEG402-5 *Design simple machine elements like helical spring, spur gear*			
9	**SPUR GEARS** 9.1 Advantages of Gear drive. 9.2 Types of gears, Nomenclature of spur gear teeth. 9.3 Standard systems of gear tooth. 9.4 Force analysis of spur gears. 9.5 The Lewi's formula, Dynamic load in spur gears.	**06**	**08**
Course Outcome MEG402-6 *Select standard components like deep groove ball bearings from manufacturer's catalogue.*			
10	**ROLLING CONTACT BEARINGS** 10.1 Classification of bearings- Sliding contact and Rolling contact 10.2 Types of rolling contact bearings. 10.3 Static load carrying capacity. 10.4 Dynamic load carrying capacity. 10.5 Equivalent Bearing load 10.6 Load-Life relationship. 10.7 Procedure for selection of bearing for single row deep groove ball bearing.	**06**	**08**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Introduction.	04	02	00	MEG402-1	06
2	Engineering materials.	01	02	01	MEG402-1	04
3	Design against steady loading.	04	06	02	MEG402-2	12
4	Design of power screws.	02	02	06	MEG402-3	10
5	Design of fasteners and threaded connections.	02	02	04	MEG402-3	08
6	Design against variable loading.	02	02	00	MEG402-1	04
7	Design of shafts, keys, and couplings.	04	04	04	MEG402-4	12
8	Mechanical springs.	02	02	04	MEG402-5	08
9	Spur gears	02	04	02	MEG402-5	08
10	Rolling contact bearings	02	04	02	MEG402-6	08
	TOTAL	25	30	25		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III.*

b) Term-end Oral Examination (External):

Term-end Oral Examination (External) shall be conducted as per the following criteria and marks to be added in *Proforma-III*:

Sr. No.	Criteria	Marks allotted
1	Preparedness for practical	5
2	Correct figures / diagrams	5
3	Design calculations.	5
4	Result table / calculations / graphs	5
5	Safety / use of proper tools	5
	Total	25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions.
ii) Laboratory experiences and laboratory interactive sessions.
iii) Time bound assignments.

Teaching and Learning resources, including references:

i) Chalk-board.
ii) Demonstrative kits.
iii) Demonstrative charts.
iv) Audio video aids through PPT
v) Animated videos

10. REFERENCE MATERIAL:

a) Books

Sr. No	Author	Title	Publisher
01	B.V. Bhandari	Machine Design	MGH
02	Khurmi –Gupta	Machine Design	MGH
03	PSG	Design Data Book	PSG
04	Shigely	Machine Design	Pearson

b) Websites:

i) http://www.mhhe.com/bhandari/dme3e
ii) https://nptel.ac.in/courses/112/105/112105124/

* * *

COURSE ID: ME

Course Name : ADVANCED MACHINING PROCESSES
Course Code : MEG403
Course Abbreviation : GAMP

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	02	06
Practical	04	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	1) 25 marks for each practical 2) One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I – Internal Assessment

2. RATIONALE:

This is an applied technology course. Due to the technological development, manufacturing processes are advancing fast. This subject will provide basic insight in the students to look to various problems on the shop floor. After getting conversant with the basic production processes, it is necessary for a diploma holder to know about the advancements in the area of production and manufacturing processes. The course will provide knowledge and skills necessary for working in modern manufacturing environment. This course will help to the students to study working principles and operations performed on milling machines, gear cutting, , non-conventional machining processes, CNC machines.

3. COMPETENCY:

Programming and simulation of simple mechanical component using CNC machines.

Cognitive : Understand various advance machining processes.

Psychomotor : i) Cut gear on milling machine. ii) Write a part program and simulate it.

Affective : Develop **a**ttitude of i) Accuracy ii) Safety iii) Precision iv) Build programming logic

4. COURSE OUTCOMES:

MEG 403-1 Classify, Specify and perform operations on milling machine.
MEG 403-2 Select various gear manufacturing methods and cut gear.
MEG 403-3 Select non-conventional machining processes.
MEG 403-4 Write a part program and simulate it.
MEG 403-5 Write coding system for a given component.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem Analysis**	**PO 3 Design /development of solutions**	**PO 4 Engineering Tools, Experimentation and Testing**	**PO 5 Engineering practices for society, sustainability and environment**	**PO 6 Project Management**	**PO 7 Life-long learning**	**PSO 1 Work in mfg& service sector**	**PSO 2 Start entrepreneurial activity**
Competency:	1	-	-	3	-	-	-	2	-
MEG306-1	1	-	-	3	-	-	-	2	-
MEG306-2	1	-	-	3	-	-	-	2	-
MEG306-3	1	-	-	3	-	-	-	2	-
MEG306-4	1	-	-	3	-	-	-	2	-
MEG306-5	1	-	-	3	-	-	-	2	-

6. CONTENT:

A) Continuous Assessment (CA):

Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	One job on gear blank turning, drilling & facing	To know the outer diameter, width, turning, facing, keyway & drilling	MEG 403-2
2	Any one Job on gear cutting/milling keyway/grooves/slots/end milling	To know & develop gear cutting methods and slot cutting on milling machines.	MEG 403 -2
3	Five CNC programming on CNC Lathe & VMC Machines having operations turning, step turning, face milling, slotting, counter machining (Group of two students, each group must use software for different dimensions)	To Program & use of basic concepts of programming of CNC lathes & VMC Machines.	MEG 403-4
4	Demonstration of producing one component on CNC production	To know & understand the basic operating system of CNC production lathe machine	MEG 403 –4

	lathe machine (Batch of 4 to 6 students)		
5	Prepare a job using Electro discharge machining / Observe the same in an industry. (Part I)	To understand the working of Electro discharge machining.	MEG 403 –4
6	Prepare a job using Electro Chemical discharge machining /Observe the same in an industry. (Part II)	To understand the working of Electro chemical machining.	MEG 403 –4
7	Assignment of part programming on machining center	To understand & develop part programming on machining centers	MEG 403 –4
8	Assignment on automation and robotics	To develop construction, working and applications of nonconventional machining methods	MEG 403-3

b. Micro-project:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more cos. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented cos. A suggestive list of micro-projects is given here. Suggested micro projects

1. Prepare a list of components which are produced through non-conventional machining processes and describe the manufacturing procedure of the same in brief.
2. Manufacture any product like a small assembly of components which has been designed in the course Design of Machine Elements. Student will prepare the report on following.
   i. Prepare production drawings of the assembly and details.
   ii. Manufacture the parts.
   iii. Note down work holding devices, cutting tools and
   iv. cutting parameters used for each part and each operation.
   v. Summarize this in tabular form.
3. Presentation after completion.
4. Produce job with various machining methods:
5. Part should include plain/taper turning, knurling, threading, cylindrical/surface grinding, etc.

B) INDUSTRIAL EXPOSURE:

S. N.	Mode of Exposure	Topic
1	Field Visit	Covering theory
2	Field examples of course application	Term-work assignment

C) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome **MEG 403-1** Classify, Specify and perform operation on milling machine.			
1	**MILLING PROCESS** 1.1 Classification 1.2 Basic parts and their functions – column and knee type 1.3 Specifications of milling machines 1.4 Milling cutters, Cutter nomenclature 1.5 Types of operations: Up milling, Down milling, Plain milling, Side and face milling, Form milling, Gang milling. End milling, Face milling, T- slot milling, Slitting 1.6 Work holding devices	**06**	**16**
MEG 403-2 Select various gear manufacturing methods and cut gear.			
2.	**GEAR MANUFACTURING** 2.1 Gear Cutting: Indexing, Indexing Methods 2.2 Gear Hobbing. 2.3 Gear Shaping: Principle, Advantages and disadvantages 2.4 Gear Finishing Processes: Shaving, Grinding, Burnishing, Lapping	**04**	**10**
Course Outcome **MEG 403-4** Select non-conventional machining processes.			
3	**NON-CONVENTIONAL MACHINING PROCESSES:** 3.1 Classification 3.2 Electro discharge machine (EDM): Construction, Working Principle, Applications, Advantages & disadvantages. 3.3 Wire cut EDM: Construction, Working principle, Applications, Advantages & disadvantages. 3.4 Electro chemical machining (ECM): Construction, Working principle, Applications, Advantages & Disadvantages. 3.5 Laser beam machining (LBM): Construction, Working principle, Applications and Advantages & Disadvantages. 3.6 Electron beam machining (EBM): Construction, Working principle, Applications and Advantages & Disadvantages.	**06**	**14**
	Total	**16**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome **MEG 403-4** Write a part program and simulate it.			
4	**CNC MACHINES** **Introduction**: 4.1 Basic components of Numerical Control System 4.2 Parts suitable for CNC machine 4.3 Horizontal, Vertical and Universal Machining Centre Principal Parts	**03**	**08**
Course Outcome **MEG 403-4** Write a part program and simulate it.			
5	**Classification of NC/CNC machines** 5.1 Classification: Based on Feedback control, Based on control 5.2 Methods of listing co-ordinates: Absolute co- ordinate system, Incremental co-ordinate system. 5.3 Axis identification in CNC machines: Linear axis, Rotary axis.	**03**	**08**
Course Outcome MEG 403-4 Write a part program and simulate it.			
6	**FUNAMENTALS OF PART PROGRAMMING.** 6.1 Objectives, NC words, Rapid Transverse Function (G00), Liner Interpolation Function (G01), Circular Interpolation Function (G02)/(G03), Dwell Function (G04), Programming Formats. 6.2 Writing a part programming 6.3 Point to point machining. Part programming for machining straight line. Machining along straight Line. Lathe Operations. 6.4 Programming for CNC milling machine Tooling for CNC. Canned cycles, Do loop, subroutine.	**05**	**12**
Course Outcome MEG 403-5 Write coding system for a given component.			
7	7.1 Automation-Define, Need of automation, high and low-cost automation 7.2 Types of Automation - Fixed automation programmable automations and Flexible automation. Comparison of types of automation. 7.3 Group Technology- concept, basis for developing part families, part classification and coding with example, concept of cellular manufacturing. Advantages and limitations. 7.4 Flexible Machining System- Introduction, concept, definition and need, sub systems of FMS, comparing with other manufacturing approaches. 7.5 Introduction to Robotics- definition of robot and robotics, advantages disadvantages and applications. 7.6 Components of Robotics manipulator, end effectors, actuators, sensors, controller, processor and software.	**05**	**12**
	Total	**16**	**40**

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Milling Machines	04	06	06	MEG 403-1	16
2	Gear Manufacturing	02	04	04	MEG 403-2	10
3	Non-Conventional Machine Process	04	04	06	MEG 403-3	14
4	CNC Machines	04	02	02	MEG 403-4	08
5	Classification of NC/CNC Machines	04	02	02	MEG 403-4	08
6	Fundamentals of part programming	04	04	04	MEG 403-4	12
7	Automation and Robotics	04	04	04	MEG 403-5	12
	TOTAL	26	26	28		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma IV*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted.

Final marks of term work shall be awarded as per *Assessment Pro-forma IV.*

b) Term-end Oral Examination (Internal):

Term-end Oral Examination (Internal) shall be conducted as per the following criteria and marks to be added in *Proforma-IV*:

Domain	Particulars	Marks out of 50
Cognitive	Understanding	05
	Application	05
Psychomotor	Operating Skills	10
	Drawing / drafting skills	10
Affective	Discipline and punctuality	10
	Decency and presentation	10
TOTAL		**50**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures

ii) Demonstrations during practicals

Teaching and Learning resources:

i) Chalk board

ii) LCD presentations

10.REFERANCES:

a) Books:

Author	Title	Publisher
S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I and II	Media Promoters and Publishers limited
B.S. Raghuvanshi	Elements of workshop Technology – Volume I and II	Dhanpat rai& Sons
R. K. Jain	Production Technology	Khanna Publication New Delhi
Production Technology	Hindustan Machine Tools (HMT)	Tata Publication
Advanced Machining Processes	Jain V. K.	Allied Publishers, Mumbai 2009
C. N. C. Machine	Pabla B. S. Aithan M.	New age international, New Delhi, 2014, ISBN: 97881224066966
Computer Numerical Control Turning and Machining Centres	Quesada Robert	Pretice Hall India, New Delhi, 2014
CAD/CAM	Sareen Kuldeep	S. Chand, New Delhi, 2012
Introduction to NC/CNC Machines	Vishal S.	S. K. Katarai and Sons, New Delhi
Computer Aided Manufacturing	Rao P. N. Tiwari N K, Kundra T	Tata McGraw Hill, New Delhi, 2017
CAD/CAM: Computer aided design and manufacturing	Groover Mikel P, Zimmered W Emory	Pretice Hall, New Delhi, 2011

b) Websites

1) http://nptel.ac.in
2) www.egr.msu.edu/~pkwon/me478
3)www.basicmechanicalengineering.com/lathe~machine~operation~basic:turning.operations
4)www.planomillers.com/drilling.machine.html
5)www.jsw.co.in/en/products/injectionmoulding
6)http://www.opm.gov/fedclass/fws3869.pdf
7)www.swikuo.com
8)www.workshopmachiery.com
9)www.thomasnet.com
10)www.sodick.com

* * *

COURSE ID: ME

Course Name : PROJECT 1
Course Code : MEG404
Course Abbreviation : GPRT

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	00	02
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	--	--	--	As per Proforma-IV	
Marks	**--**	As per Proforma-IV	**--**	**50 I**	**50**

I- Internal Assessment

2. RATIONALE

Most of the engineering activities fall within the category of pre-project preparation i.e. seminar requiring individual or group decisions, variety of solutions. The purpose of providing seminar in the curriculum is to expose the students to such situations so that they can gain confidence in taking decisions and taking their problem on their own. The emphasis on the project work must shift from teacher centre to student-centre activities and the creative ability of the student to come forward.

A technician should be able to effectively communicate ideas. Proper group functioning is a prerequisite for maximizing output from a problem- solving group in work environment. The students are able to work effectively in a group and thus gain confidence to take up responsibilities in their careers.

3. COMPETENCY:

Develop innovative and creative ideas and check their feasibility for project work.

a) Cognitive : 1. Idea generation
2. Selection of feasible idea
3. Apply project management techniques

b) Psychomotor: Survey and prepare pre-project seminar report

c) Affective : Attitude of i) Safety ii) Punctuality iii) Self-expression/Communication iv) Analytical Thinking v) Interpersonal relation vi) Team work

4. COURSE OUTCOMES:

MEG404-1: Identify, analyse & define the problem
MEG404-2: Develop alternative solutions to the problem identified
MEG404-3: Compare & select feasible solutions from alternatives generated
MEG404-4: Prepare detailed feasibility report
MEG404-5: Apply different work scheduling techniques
MEG404-6: Develop and present pre-project seminar report

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design /development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 Project Management	PO 7 Life- long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	-	-	-	-	-	3	2	1	2
MEG404-1	-	-	-	-	-	3	2	2	3
MEG404-2	-	-	-	-	-	3	2	2	3
MEG404-3	-	-	-	-	-	3	2	1	3
MEG404-4	-	-	-	-	-	3	2	1	2
MEG404-5	-	-	-	-	-	3	2	1	3
MEG404-6	-	-	-	-	-	3	2	1	3

6. CONTENT

Components of Pre Project-Report:

1. Project Summary (One page summary of entire project)
2. Introduction (Promoters, Market Scope/ requirement)
3. Project Concept & Product (Details of product)
4. Promoters (Details of all Promoters- Qualifications, Experience, Financial strength)
5. Manufacturing Process & Technology
6. Plant & Machinery Required
7. Location & Infrastructure required
8. Manpower (Skilled, unskilled)
9. Raw materials, Consumables & Utilities
10. Working Capital Requirement (Assumptions, requirements)
11. Market (Survey, Demand & Supply)
12. Cost of Project, Source of Finance
13. Projected Profitability & Break-Even Analysis
14. Conclusion

Project-1 Seminar

Following activities related to project are required to be dealt with, during this semester

1. Form project batches & allot project guide to each batch. (Max. 4 students per batch)
2. Each project batch should select topic / problem / work by consulting the guide & / or industry. Topic / Problem / work should be approved by Head of department.
3. Each project batch should prepare action plan of project activities & submit the same to respective guide.
4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities.
5. Action Plan should be part of the project report.

Seminar Report:

1. Every project group shall prepare & deliver the seminar. Evaluation of seminar will be carried out by
2. Panel of at least three teaching staff from mechanical department.
3. Selection of topic for the seminar should be finalized in consultation with teacher guide allotted for the batch to which student belongs.
4. Seminar report should be of min.10 & max. 20 pages & it should be certified by guide teacher and head of the department.
5. for presentation of seminar, following guide lines are expected to be followed:
   a) Time for presentation of seminar : 7 to 10 minutes /student.
   b) Time for question/answer : 2 to 3 minutes /student.
   c) Evaluation of seminar should be as follows:
   d) Use of audio-visual aids or power point presentation is desirable.
6. Topic of the seminar should not be from diploma curriculum
7. Seminar shall be based on tentative topic of project such as review paper on some specific well-defined area/ specialized stream of mechanical engineering.

7. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL EXAMINATION

a) Term-end Oral Examination (Internal):

Term-end Practical Examination (**Internal**) shall be conducted as per the following criteria and marks to be added in *Proforma-IV*:

Assessment of project-1 work shall be assessed according to following criteria:

Sr. No.	Criteria	Marks allotted
1	Market survey	15
2	Project concept	10
3	Presentation of seminar/Oral	10
4	Participation in work and understanding level	15
	Total	**50**

Assessment shall be done as per *Proforma-IV*.

8. INSTRUCTIONAL STRATEGIES:

1)Guidance and discussions.

2)Laboratory experiences and laboratory interactive sessions.

3)Time bound assignments.

* * *

COURSE ID: ME

Course Name : PROJECT 2
Course Code : MEG405
Course Abbreviation : GPRO

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : MEG404

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	00	04
Practical	04	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	--	--	--	As per Proforma-III	
Marks	**--**	As per Proforma-III	**--**	**100 E**	**100**

E-External Examination

2. RATIONALE:

In practice the diploma technicians come across problems of varied nature. He/she will have to solve the problems involving drawings, designs, manufacturing, installation, testing and Maintenance of machines. In order to cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, this particular subject is introduced. This subject will also help to enhance the generic skills & professional skills.

3. COMPETENCY

Design and develop a working model of machines.

a) Cognitive : Apply design theory and project management principles to design and develop machine

b) Psychomotor: Fabricate/Manufacture/Assemble machine parts and demonstrate its working

c) Affective : Attitude of i) Safety ii) Punctuality iii) Self-expression/Communication iv) Analytical Thinking v) Interpersonal relation vi) Team work

4. COURSE OUTCOMES:

MEG405-1: Identify, analyze & define the problem
MEG405-2: Generate alternative solutions to the problem identified
MEG405-3: Compare & select feasible solutions from alternatives generated
MEG405-4: Design various machine components
MEG405-5: Assemble various machine parts and demonstrate its working
MEG405-6: Prepare a detailed project report

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	-	-	-	-	-	3	2	1	2
MEG405-1	-	-	-	-	-	3	2	2	3
MEG405-2	-	-	-	-	-	3	2	2	3
MEG405-3	-	-	-	-	-	3	2	1	3
MEG405-4	-	-	-	-	-	3	2	1	2
MEG405-5	-	-	-	-	-	3	2	1	3
MEG405-6	-	-	-	-	-	3	2	1	3

6. CONTENT

Following activities related to project are required to be dealt with, during this semester.

1. Form project groups of max. 4 students in each group.
2. Each project group shall work on the problem identified in project-I by consulting the guide or industry.
3. Topic / Problem / work shall be approved by guide and Head of department.
4. Each project batch shall prepare action plan of project activities & submit the same to respective guide.
5. Mid-term evaluation of project work shall be done by departmental evaluation committee.
6. At the end of semester, each project batch shall submit the project report and project.

Components of Project Report:

1. Title and cover page
2. Declaration
3. Certification and/or Industry sponsored project certificate
4. Acknowledgement
5. Abstract
6. Table of contents
7. List of figures
8. List of tables
9. List of symbols and Abbreviations
10. Introduction
11. Literature review
12. Body of Project write-up (Chapter wise)
13. Experiments and Results
14. Conclusion and Recommendations
15. Future Scope
16. References

Project report preparation Format:

1. Project report shall be printed on white A4 bond paper.
2. The text shall have a standard font of Times New Roman of 12 pts. With 1.5 line spacing.
3. The printed sheets shall have the following written area and margins

   Top margin : 15mm
   Head height : 3 mm
   Head separation : 12 mm
   Bottom margin : 22 mm
   Footer : 3 mm
   Left margin : 30 mm
   Right margin : 20 mm
4. Each chapter shall begin on a fresh page and title shall be printed at the centre of the line in 18 pt. in bold using both upper and lower case.
5. Heading of the chapter shall have 16 pt. in bold and sub-heading shall have 14 pt in bold.
6. Project report shall be prepared with following nos;
   a. One copy for Department
   b. One copy for project Guide
   c. One copy each for students in project group
7. Project report shall be prepared with hard bound covers with cover page matter in golden embossing printing on front cover.

7. ASSESSMENT CRITERIA FOR ORAL:

i) Assessment for Project work based on oral examination shall be done as per following criteria:

Sr. No.	Criteria	Marks allotted
1	Attendance at regular practical	05
2	Market survey	10
3	Project concept	10
4	Presentation of seminar/Oral	25
5	Participation in work and understanding level	25
6	Project Report	25
	Total	**100**

Assessment shall be done based on *Proforma-III*.

8. INSTRUCTIONAL STRATEGIES:

1) Guidance and discussions.
2) Laboratory experiences and laboratory interactive sessions.
3) Time bound assignments.

* * *

COURSE ID: ME

Course Name : FLUID MECHANICS & MACHINERY
Course Code : MEG406
Course Abbreviation : GFMM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	04	06
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Practical Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E-External Examination

2. RATIONALE:

Knowledge of fluid flow & related machinery is essential in all fields of engineering. Hydraulic machines have important role in power generation, water supply and irrigation and also in most of engineering segments. This subject requires knowledge of basic engineering sciences, applied mechanics, mathematics etc. The fundamentals of this subject are essential for the subject "Industrial Fluid Power" in sixth semester.

3. COMPETENCY:

Operation and performance evaluation of hydraulic machines

a) Cognitive : -Describe basics of fluid mechanics & working of hydraulic machines

b) Psychomotor: Measurement of various fluid parameters and conduct trials on hydraulic machines

c) Affective : Attitude of i) Analytical Thinking ii) Safety

4. COURSE OUTCOMES:

MEG406.1 Measure fluid pressure by using various pressure measuring instruments.
MEG406.2 Classify various types of flows and measures the rate of flow using flow meters.
MEG406.3 Calculate loss of head in flow through various pipe systems.
MEG406.4 Analyze the effects of Impact of jet on vane in various conditions.
MEG406.5 Compute power and efficiency of hydraulic turbines.
MEG406.6 Conduct trial on performance testing of pumps.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Lifelong learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	2	3	3	2	2	2	3	3	3
MEG406-1	2	2	3	2	1	-	3	1	1
MEG406-2	1	3	2	3	1	-	2	1	1
MEG406-3	1	3	2	2	2	2	2	2	2
MEG406-4	1	2	1	2	2	1	2	2	2
MEG406-5	1	3	3	3	-	3	2	3	3
MEG406-6	2	3	3	2	-	2	2	3	3

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Measurement of Pressure using different pressure measuring devices.	Ability to select and use appropriate pressure measuring devices.	MEG406.1
2	Verify Bernoulli's Theorem.	Ability to measure the Total Energy available at different sections of a pipe layout.	MEG406.2
3	To determine Coefficient of friction for flow through pipes.	Ability to use manometer and measurement of discharge.	MEG406.3
4	Trial on Pelton Wheel.	Measurement of head, discharge, power, efficiency.	MEG406.5
5	Demonstration on Francis Turbine.	Measurement of head, discharge, power, efficiency.	MEG406.5
6	Trial on centrifugal pump.	Measurement of head, calculation of pump efficiency.	MEG406.6
7	Trial on Reciprocating pump.	Measurement of head, calculation of pump efficiency.	MEG406.6
8	Trial on centrifugal pump.	Measurement of head, calculation of pump efficiency.	MEG406.6
9	Maintenance and troubleshooting for centrifugal pumps.	Find out different problems & remedies for centrifugal pump.	MEG406.6
10	Industrial visit to Hydro-electric Power plant & Report.	Lay out study and specifications of turbines	MEG406.5

b) Micro-project:

A suggestive list of micro-projects is given here. Similar micro-projects can be added by concerned faculty

i) Prepare pipe layout of water supply of your lab from supply reservoir and calculate the loss of head.
ii) Prepare a demonstration model of hydroelectric power plant.
iii) Calculate the running cost of your household pump and verify the electricity bill.
iv) Case study on any one of hydroelectric power plant in Maharashtra, India and World.
v) Visit hydroelectric power plant and write a report.
vi) Download catalogue of pump manufacturer like Kirloskar, cri, texmo etc. and compare their parameters
vii) Dissemble and assemble centrifugal pump for fault finding, troubleshooting and to identify warn out parts.
viii) Visit to nearby pump manufacturing unit.

B. THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome MEG406-1 **1** Measure fluid pressure by using various pressure measuring instruments.			
01	**PROPERTIES OF FLUID AND FLUID PRESSURE** 1.1 Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility 1.2 Fluid pressure, Pressure head, Pressure intensity, Concept of absolute vacuum, gauge pressure, atmosphere pressure, absolute pressure; Pressure head measurement by Simple and differential manometer. 1.3 Concept of total pressure, center of pressure on immersed bodies in horizontal, vertical and inclined positions	**14**	**18**
Course Outcome MEG406-2 Classify various types of flows and measures the rate of flow using flow meters.			
02	**FLUID FLOW** 2.1 Types of fluid flows 2.2 Continuity equation, Bernoulli's theorem, Reynolds's number. 2.3 Venturimeter: Construction, principle of working, Coefficient of discharge, Derivation of discharge through Venturimeter. 2.4 Orifice meter: Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter 2.5 Pitot tube: Construction, Principle of Working	**10**	**12**
Course Outcome MEG406-3 Calculate loss of head in flow through various pipe systems.			
03	**FLOW THROUGH PIPES** 3.1 Laws of fluid friction (Laminar and turbulent) Darcy's equation and Chezy's equation for frictional losses.	**08**	**10**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	3.2 Minor losses in pipes 3.3 Hydraulic gradient and total gradient line. 3.4 Hydraulic power transmission through pipe, transmission efficiency, water hammer and its effects.		
Course Outcome MEG406-3-*Calculate major & minor friction losses in flow through pipes.*			
	Total	**32**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome MEG406-4 Analyze the effects of Impact of jet on vane in various conditions.			
4	**IMPACT OF JET** 4.1 Impact of jet on fixed vertical, moving vertical flat plates. 4.2 Impact of jet on curved vanes with special reference to turbines & pump	**04**	**06**
Course Outcome MEG406-5 Compute power and efficiency of hydraulic turbines.			
5	**HYDRAULIC TURBINES** 5.1 Layout of hydroelectric power plant. 5.2 Features of Hydroelectric power plant. 5.3 Classification of hydraulic turbines**.** 5.4 Selection of turbine on the basis of head and discharge available 5.5 Construction and working principle of Pelton wheel, Francis and Kaplan turbine. 5.6 Draft tubes: Types and construction, Concept of cavitations in turbines. 5.7 Velocity diagram for Pelton wheel & Francis turbine. 5.8 Calculation of Work done, Power developed losses & different efficiency.	**14**	**18**
Course OutcomeMEG406.6- Conduct trial on performance testing of pumps.			
6	**PUMPS** 6.1 **CENTRIFUGAL PUMPS:** Construction, principle of working and applications; Types of casings and impellers. Priming and its methods, Cavitations; Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH 6.2 Performance Characteristics of Centrifugal pumps and its Trouble Shooting Construction, working and applications of multistage pumps	**14**	**16**

Sr. No.	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	6.3 Construction, working and applications of submersible, jet pump 6.4 **RECIPROCATING PUMP:** Construction, working principle and applications of single and double acting reciprocating pumps; Concept of Slip, Negative slip, Cavitation and separation 6.5 Air Vessels, functions & advantages; 6.6 Indicator diagram with effect of acceleration head & frictional head		
	Total	**32**	**40**

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Properties of Fluid and Fluid Pressure	4	6	8	MEG406.1	18
2	Fluid flow	4	4	4	MEG406.2	12
3	Flow through pipes	2	4	4	MEG406.3	10
4	Impact of Jets	2	-	4	MEG406.4	6
5	Hydraulic Turbines	6	4	8	MEG406.5	18
6	Pumps	6	4	6	MEG406.6	16
TOTAL		24	22	34		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. CONTINUOUS ASSESSMENT CRITERIA

a) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *ProformaIII*.

b) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III*

c) Term-end Practical Examination (External):

Term-end Practical Examination (External) shall be conducted by internal-external examiners as per the following assessment criteria and marks to be added in *ProformaIII*:

Sr. No.	Criteria	Marks allotted
1	Attendance at regular practical	3

2	Preparedness for oral	5
3	Correct figures / diagrams	5
4	Observation tables	5
5	Result table / calculations / graphs	5
6	Safety / use of proper tools	2
	Total	**25**

10. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations

11. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr.No.	Author	Title	Publisher
01	R.S. Khurmi	Hydraulic Machinery	S chand.
02	S.K.Agrawal	Fluid mechanics & machinery.	Tata McGraw Hill
03	R. K. Bansal	Fluid mechanics & machinery	Tata McGraw Hill
04	Modi & Seth	Fluid Mechanics	Rajsons
05	R. K. Rajput	Fluid mechanics &hydraulic machinery	S chand.

b) Websites

i) http://en.wikipedia.org/wiki/Applied_mechanics
ii) www.nptel.ac.in/courses www.learnerstv.com www.ni.com/multisim
iii) https://www.youtube.com/watch?v=e6a2q9k2JCA
iv) https://www.youtube.com/watch?v=5TTnFccqJEE
v) https://www.youtube.com/watch?v=3Gq3tR3fkM0
vi) https://www.youtube.com/watch?v=UNBWI6MV_lY
vii) https://www.youtube.com/watch?v=ljMVt7T4HQM
viii) https://www.youtube.com/watch?v=wnOQMk7pKak
ix) https://www.youtube.com/watch?v=IcJOkRZPNMI
x) https://www.youtube.com/watch?v=w7n0srAzm8g

* * *

COURSE ID: ME

Course Name : SOLID MODELING
Course Code : MEG414
Course Abbreviation : GSMD

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	01	03
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**--**	As per Proforma-III	**--**	**50 E**	**50**

E- External Examination

2. RATIONALE:

The market driven economy demands frequent changes in product design, data collection, analysis & retrieval at much faster rates. Computers play very important role in this diversified fields such as CAD, CAM, CIM and simulation etc. It is essential for a Diploma Technician to have a knowledge regarding the latest Solid Modeling software used in the industries and to acquire skill in operating different software's available such as Pro-E/ Creo, Catia, Solid Works, Unigraphics etc.

The focus of this course is to provide the students with hands-on experience in developing 3D models, assemblies & producing Industrial production drawings and also making them competent in latest solid modeling and assembly practices

3. COMPETENCY:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Develop 'Solid Models' of given machine components using any parametric CAD software.

4. COURSE OUTCOMES:

MEG414-1 Prepare 2D Drawing using sketcher workbench of any parametric CAD software.

MEG414-2 Generate 3D Solid models from 2D sketch using Part workbench of any parametric CAD software.

MEG414-3 Prepare assembly of part models using Assembly workbench of any parametric CAD software.

MEG414-4 Generate orthographic views of 3D solid models/assemblies using drafting Workbench of any parametric CAD software.

MEG414-5 Plot/Print a drawing for given part model/assembly

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 Project Management	PO 7 Lifelong learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency:	3	-	2	2	-	1	2	3	1
MEG414-1	3	-	-	2	-	-	-	1	1
MEG414-2	3	1	3	2	-	-	-	2	1
MEG414-3	3	1	3	2	-	1	2	3	1
MEG414-4	3	-	1	1	-	1	2	2	1
MEG414-5	-	-	-	2	-	-	-	1	1

6. CONTENT:

A) Continuous Assessment (CA):

b) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Prepare drawing template consisting of name plate, boundary lines and projection symbol	Draw name plate, boundary lines and projection symbol using 3-D modeling software	MEG414-1
2	Draw and print 2D sketches of the machine parts using 3-D modeling software (Minimum 02)	Draw and print 2D sketches using 3-D modeling software	MEG414-1
3	Create simple parts using features like extrude, revolve, ribs, chamfer, fillet, hole, pattern etc. from the given orthographic views. (Select minimum 03 parts of given assembly)	Create simple 3D parts using 3-D modeling software	MEG414-2

4	Generate drawing views of Parts created in Ex. No.-3 on the drawing template giving all dimensions and print on A4 size paper	Generate drawing views using 3-D modeling software	MEG414-5
5	Create complex parts using features extrude, revolve, sweep, ribs, chamfer, fillet, hole, pattern, draft, and shell etc. from the given pictorial view. (Select minimum 05 parts of given assembly)	Create complex 3D parts using 3-D modeling software	MEG414-3
6	Generate drawing views of Parts created in Ex. No.-5 on the drawing template giving all dimensions and print on A4 size paper	Generate drawing views using 3-D modeling software	MEG414-5
7	Assemble parts created in Ex. No. 3. Generate orthographic views of assembly on the drawing template. Prepare Bill of material. Create assembly views in Section. Print on A4 size paper.	Assemble 3D parts using 3-D modeling software	MEG414-4
8	Assemble parts created in Ex. No. 5. Generate orthographic views of assembly on the drawing template. Prepare Bill of material. Create assembly views in Section. Print on A4 size paper.	Assemble 3D parts using 3-D modeling software	MEG414-4
9	Create exploded view of assemblies created in Ex. No. 8. Generate view and print on A4 size paper.	Create exploded view using 3-D modeling software	MEG414-4

b) Micro-project:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. 2D drawing: students will collect one or two drawings from the nearby industry/workshop and prepare model and generate 2D drawing production drawings from it.
b. 3D model: student will identify a small assembly from the institute workshop/laboratory. Measure the dimensions of each part and prepare sketches. Using sketches prepared 3D model of parts and assembly. Plot the assembly and detail drawings. (e.g., Bench vice, Machine vice, Tool post, Couplings, Joints, Bearings etc.)

c. Create models for parts to be manufactured in their manufacturing type of project and generate assembly and detail drawings.

Evaluation shall be of 25 marks and marks should be added in Profoma-III

B) INDUSTRIAL EXPOSURE:

Included in Micro-project

C) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome MEG414-1 *Prepare 2D Drawing using sketcher workbench of any parametric CAD software.*			
1	**INTRODUCTION TO SOLID MODELING** 1.1 Introduction to CAD, CAM and CAE. Various available CAD software. Parametric, associative and feature based nature of CAD/modeling software. 1.2 Tool bars: -Standard Toolbar, Sketch Toolbar, Relationship Toolbar, View Toolbar, Drawing Toolbar, Feature Toolbar, Annotation Toolbar 1.3 Feature Manager Design Tree: Design Manager, Property Manager, Configuration Manager. 1.4 Selection Method: Selection from Design Tree, Graphic Area	**02**	**00**
Course Outcome MEG414-1 *Prepare 2D Drawing using sketcher workbench of any parametric CAD software.*			
2	**SKETCHING** 2.1 Drawing tools: Line, Rectangle, Circle, Arc, Ellipse, Spline, etc. 2.2 Editing tools: Trim, Extend, Erase, Mirror, etc. 2.3 Modify tools: Chamfer, Fillet, Copy, Move, etc. 2.4 Linear, angular dimensions. 2.5 Dimensioning constraint and Geometrical constraint. 2.6 Drawing template: prepare drawing template consisting of Name plate, boundary lines and projection symbol.	02	00
Course Outcome MEG414-2*Generate 3D Solid models from 2D sketch using Part workbench of any parametric CAD software*			
3	**PART MODELING** 3.1 Reference Geometry: Creating axis, Creating reference planes 3.2 Part tool: Extrude, Revolve, Sweep, swept blend, Pattern, Hole, Rib etc. 3.3 Part Editing tool: Trim, Extend, Erase, Mirror etc. 3.4 Part Modify tool: Chamfer, Round, Copy, Move, Draft, Shell etc. 3.5 Boolean operations: Union, subtract, intersection.	04	00

Section II			
Course Outcome MEG414-3*Prepare assembly of part models using Assembly workbench of any parametric CAD software.*			
4	**ASSEMBLY OF PARTS** 4.1 Assembly toolbar, Feature manager deign tree conventions. 4.2 Assembly constraints. 4.3 Exploded view. Generating Exploded view. View manager tools.	**04**	**00**
Course Outcome MEG414-4*Generate orthographic views of 3D solid models/assemblies using drafting workbench of any parametric CAD software*			
5	**DRAFTING OF 3D PART/ASSEMBLY** 5.1 Creating Drawings: standard templates, Sheet setup 5.2 Adding part/assembly in drawing module. 5.3 Generating orthographic views, isometric views. Creating sectional views, auxiliary view, detailed view, exploded view. 5.4 Annotations: Adding dimensions, notes, bill of material.	**02**	**00**
Course Outcome MEG414-5*Plot/Print a drawing for given part model/assembly*			
6	**PLOTTING AND PRINTING** 6.1 Page setup, print selection, Paper Size, Print Preview and print document.	**02**	**00**

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic no.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total marks
		Remember	Understand	Applica-tion		
1	Introduction to solid modeling	-	-	-	MEG414-1	-
2	Sketching	-	-	-	MEG414-1	-
3	Part modeling	-	-	-	MEG414-2	-
4	Assembly of parts	-	-	-	MEG414-3	-
5	Drafting of 3d part/assembly	-	-	-	MEG414-4	-
6	Plotting and printing	-	-	-	MEG414-5	-
	Total	-	-	-	-	-

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL EXAMINATION

a) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

b) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III.*

c) Term-end Practical Examination (External):

Term-end Practical Examination (External) shall be conducted as per the following criteria and marks to be added in *Proforma-III*:

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	05
2	Use and selection of proper commands	10
3	Printing/plotting of drawings	05
4	Discipline and punctuality	03
5	Safety / use of proper tools	02
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Laboratory experiences and laboratory interactive sessions.
ii) Time bound assignments.

Teaching and Learning resources:

i) Chalk-board.
ii) Demonstrative kits.
iii) Demonstrative charts.
iv) Audio video aids through PPT
v) Animated videos

10 REFERENCE MATERIAL:

a) Books / Codes

Sr. No.	Author	Title	Publisher
1.	Sham Tickoo	CATIA for Designers	Softcover, Cadcim Technologies
2.	Sham Tickoo	Pro/Engineer Wildfire 5.0 for Designers	Softcover, Cadcim Technologies
3	Sham Tickoo	Solid Works for Designers	Softcover, Cadcim Technologies
4	Sham Tickoo	Autodesk Inventor for Designers. Release 10	Softcover, Cadcim Technologies
5	Sham Tickoo, Deepak Maini	NX4 for designers	Softcover, Cadcim Technologies
6	M Groover	CAD/CAM	Pearson Education

b) Websites:

1. www.nptel.com
2. https://en.wikipedia.org/
3. www.slideshare.net/
4. http://www.solidworks.inlsw/products/3d-cad/3d-solid-modeling.htm
5. https: llwww.youtube.com/watch?v=vjX4PDJcFOI
6. https://www.youtube.com/watch?v=5BDHS4FN2-
7. https://www.youtube.com/watch?v=JjKs-lePlPY

8. https://www.youtube.com/watch?v=LaPp6DiYdOY&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6
9. https://www.youtube.com/watch?v=MoHbGBb5_HE&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=2
10. https://www.youtube.com/watch?v=EfBVhLoWCqc&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=3
11. https://www.youtube.com/watch?v=2ahR_9M9DVs&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=4
12. https://www.youtube.com/watch?v=Z5ALvJf3sn0&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=5
13. https://www.youtube.com/watch?v=ku3u6jcaJtY&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=6
14. https://www.youtube.com/watch?v=R00W6bstVe4&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=9
15. https://www.youtube.com/watch?v=vSBp4ZXntSU&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=10
16. https://www.youtube.com/watch?v=UH_6-JigVcY&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=20
17. https://www.youtube.com/watch?v=6glpCzXvCbw
18. https://www.youtube.com/watch?v=Xf953H-WHqg
19. https://www.youtube.com/watch?v=xCR6wK1avyc
20. https://www.youtube.com/watch?v=OooD3Qib_q0
21. https://www.youtube.com/watch?v=5u4-xMnl2aQ
22. https://www.youtube.com/watch?v=hA27dgnjI9Y
23. https://www.youtube.com/watch?v=hpMFQnyqfg8
24. https://www.youtube.com/watch?v=IyJMksXemsA
25. https://www.youtube.com/watch?v=UH_6-JigVcY&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=20
26. https://www.youtube.com/watch?v=1DSJ795_3i0
27. https://www.youtube.com/watch?v=rK-4O0E6pCA
28. https://www.youtube.com/watch?v=JPJ2WXOCvyM
29. https://www.youtube.com/watch?v=CeK17bZo2k4
30. https://www.youtube.com/watch?v=QvWGAMLFxTY&list=PLbjkHL0f0OsgqYNDDMhk4EOh_pbNRinc6&index=18
31. https://www.youtube.com/watch?v=_qo7wUJbHf4
32. https://www.youtube.com/watch?v=Gsdy5cK5V8E

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COURSE ID: ME

Course Name : MECHATRONICS AND ROBOTICS
Course Code : MEG415
Course Abbreviation : GMTR

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) :<*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	02	04
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (Internal)	
Details of Evaluation	--	i. 25 marks for each practical ii. One PST of 25 marks	--	As per Proforma-IV	
Marks	**-**	As per Proforma-IV	**-**	**50 I**	**50**

I- Internal Assessment

2. RATIONALE:

Development in technology has led to the development of new trends in manufacturing industry such as CNC machine, automation etc which consists of combination of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering and that is referred as Mechatronics. In industrial sector, knowledge of mechatronics forms a vital part in the design and manufacture of wide range of engineering products and processes. As a consequence, there is a need for a diploma engineer to understand fundamental facts, concepts, principle and application of mechatronics systems which enables him to work as technician. Knowledge of industrial robots and associated systems enables students to perform key roles in a number of industries like robotics, aerospace, transportation, defence, automotive, building systems and manufacturing industries.

3. COMPETENCY:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Operate and manipulate mechatronics systems as per requirements.

a) Cognitive : -Identify and select various transducers, sensors and actuators.

b) Psychomotor: Use of various transducers, sensors, actuators, microprocessor and microcontroller**.**

c) Affective : Attitude of i) Analytical Thinking ii) Accuracy ii) Precision.

4. COURSE OUTCOMES:

MEG415.1- Identify various mechanical components, microprocessors and software in mechatronics-based systems.

MEG415.2- Select and use transducer and sensors for different mechatronics applications.

MEG415.3- Select and use actuators for different mechatronics applications

MEG415.4- Select and use microprocessor and microcontroller for various mechatronics based applications

MEG415.5- Select and Programme PLC for various applications

MEG415.6- Select, compare and maintain different components of Robotics systems for a particular application

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": No correlation]

Competency and Cos	Programme outcome POs and PSO's								
	PO 1 Basic and Discipline specific knowledge	PO 2 Problem Analysis	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & testing	PO 5 Engineering Practices for society, sustainability and Environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency	1	-	-	3	1	-	1	1	-
MEG415-1	1	-	-	3	1	-	1	1	-
MEG415-2	1	-	-	3	1	-	1	1	-
MEG415-3	1	-	-	3	1	-	1	1	-
MEG415-4	1	-	-	3	1	-	1	1	-
MEG415-5	1	-	-	3	1	-	1	1	-
MEG415-6	1	-	-	3	1	-	1	1	-

6. CONTENT:

A. PRACTICAL WORK

a) The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Select sensors, actuators, transducers, PLC and Microcontrollers for given application with justification.	Identify various mechanical components, sensors, actuators microprocessors.	MEG415.1
2	Prepare small circuits using different sensors and interfacing with PLC used in Mechatronics systems	Prepare small circuit for particular application.	MEG415.2
3	Prepare small circuits using different transducers like linear and rotary transducers with PLC.	Prepare small circuit for particular application.	MEG415.2
4	Prepare small circuits for door open and closed application using different actuators with PLC	Prepare small circuit for particular application	MEG415.3

5	Develop ladder diagram and program PLC for Timers and Counters	Write PLC program and apply for specific situation	MEG415.3
6	Develop ladder diagram and program PLC for Temperature control.	Write PLC program and apply for specific situation	MEG415.3
7	Build Electro-pneumatic circuits for given applications	Operation and selection of Various actuators	MEG415.4
8	Develop ladder diagram and program PLC for simulation of a pedestrian traffic controller.	Write PLC program and simulate	MEG415.5
9	Develop ladder diagram and program PLC for Washing machine control	Write PLC program and apply for specific situation	MEG415.5
10	Develop ladder diagram and program PLC for Lift elevator control	Write PLC program and apply for specific situation	MEG415.5
11	Simulate the working of cylindrical, spherical and Cartesian Robots showing different degrees of freedom.	Simulate and maintain different components of Robotics systems	MEG415.6
12	Simulate the working of Pick and place robot	Simulate, compare and design of appropriate robot for a particular application	MEG415.6

Any 10 experiments from above need to be performed.

b) MICRO PROJECT:

A suggestive list of micro-projects is given here.

1. Predict and test the performance of sensors and actuators of various kinds and write report.
2. Visit to automobile workshop and identify the various sensors and mechatronics application used in car and prepare report about their location, functions.
3. Visit a power plant or manufacturing industry and identify situation where automation, mechatronics and robotics applications are used and write report.
4. Prepare a report on use of mechatronics system in washing machine, microwave oven, lift, ATM etc
5. Perform speed control of AC and DC drives write report.
6. Design and testing of fluid power circuits to control velocity, direction and force of single acting and double acting actuators

B. INDUSTRIAL EXPOSURE:

SN	Mode of Exposure	Topic
1	Expert Lecture from Industry	Mechatronics System and application

Evaluation of Micro project shall be of 25 marks and marks should be added in proforma IV

C) THEORY:

SECTION-I

Sr. No	Topics / Sub-topics	Lectures (Hours)
MEG415.1- *Identify various mechanical components, microprocessors and software in mechatronics-based systems.*		
1	**BASIC MECHATRONICS SYSTEM** 1.1 Mechatronics - Introduction, need and scope Block diagram of general Mechatronics system showing various components 1.2 Control Systems - Open and Closed Loop Systems, Basic Elements of closed loop system.	**04**
MEG415.2-*Select and use* transducer and *sensors for different mechatronics applications.*		
2	**TRANSDUCER AND SENSORS** 2.1 Transducers: Introduction, Classification, working of Primary and Secondary transducers, Mechanical Device as Primary detector. Electrical Transducers,Active and Passive Transducers, Analog and Digital Transducers 2.2 Sensors: Introduction, need of sensors, classification, contact and non-contact type, 2.3 Working and Application of- Potentiometer Sensors, Strain gauge elements, capacitive elements, proximity sensors, inductive sensors, light, pressure, pneumatic and piezoelectric sensors 2.4 Selection of Sensors	**06**
MEG415.3-*Select and use actuators for different mechatronics applications*		
3	**ACTUATORS** 3.1 Actuators: Introduction, classification and need of actuators 3.2 Hydraulic actuation system: Single and double acting, components and working, Hydraulic Valves-Directional control valves, Pressure control valve, Hydraulic Actuators 3.3: Pneumatic actuation system: components and Working, Pneumatic Actuator, Rotary Actuators, Gear Motors and Vane Motors 3.4 Electrical Actuation Systems - Electrical Switching Devices, Solenoid type devices, Drive Systems, Mechanical Switches, Electro-Mechanical and Solid-State Relays, Electromagnetic principles, Solenoids, Electromagnetic Relay, Reed Relay, Mercury wetted reed relay. 3.5 Electric motors: Construction and working, Field- current, Field-Field Interaction, D.C. Motor 3.6 Stepper motors. 3.7 Servomotor and Variable Frequency Drives (VFD) 3.8 Selection of motors/actuators.	**06**
	Total	**16**

SECTION-II

Sr. No.	Topics / Sub-topics	Lectures (Hours)
MEG415.4- *Select and* use microprocessor and microcontroller for various mechatronics-based applications.		
4	**MICROPROCESSORS, MICROCONTROLLERS AND DATA ACQUISITION** 4.1 Introduction of Microprocessor and Microcontroller, Microprocessor systems -Buses, Memory, Input/Output 4.2 Architecture and Pin configuration of 8051Microcontroller, working of Microcontroller and applications. 4.3 Comparison of Microprocessor and Microcontroller 4.4 Application of mechatronics system 4.5 Generalized data Acquisition system 4.6 Data loggers-working and application 4.7 Analog to Digital conversion: A/D Converters-Successive Approximation A/D Converter, A/D Flash Converter, 4.8 Digital to Analog conversion 4.9 Interfacing of D/A and A/D converter with microcontroller.	**07**
MEG415.5- *Select and Programme PLC for various applications*		
5	**PROGRAMMABLE LOGIC CONTROLLER** 5.1 Programmable Logic Controller (PLC)- Introduction, PLC definition, Basic PLC functions, structure, PLC block diagram, 5.2 Selection of PLC 5.3 Programming Formats, Ladder diagrams and sequence listing, PLC auxiliary commands and functions	**03**
MEF415.6- *Select, compare and maintain different components of Robotics systems for a particular application*		
6	**ROBOTICS** 6.1 Robotics: Definition of robots, Types of robots, Selection of robots 6.2. Robot Classifications: degrees of freedom; degrees of movements, robot configuration; accuracy and repeatability, specification of a robot, actuators and sensors, drives and transmission systems used in robotics. Block diagram and function of each component (sensors, drive system, control system, end effectors), construction and degrees of freedom of cylindrical, spherical and Cartesian Robots, applications of robots 6.3 Microcontroller based pick and place robots 6.4 Sensors in robotics-tactile sensors-proximity and range sensors-miscellaneous sensors and sensor-based systems-use of sensors in robotics.	**06**
	Total	**16**

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term Progressive Skill Test of 25 marks shall be conducted.

Final Assessment of Practical work shall be done as per Pro-forma IV

b) Term-end Practical Examination (Internal):

Term-end Practical Examination (Internal) shall be conducted by Internal examiners as per the following assessment criteria and marks to be added in Proforma-IV:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	2
	Application	3
Psychomotor	Operating Skills	5
	Drawing / drafting skills	5
Affective	Discipline and punctuality	5
	Decency and presentation	5
TOTAL		25

Final Assessment of Practical work shall be done as per Pro-forma IV.

8. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Demonstrations
ii) Laboratory Practices

Teaching and Learning resources:

i) Chalk board
ii) LCD
iii) Video presentations
iv) Assignments

9. REFERENCE MATERIAL:

a) Books

Sr. No.	Author	Title	Publisher
1	Bolton W	Mechatronics-	Pearson Education Ltd
2	Histand B.H. and Alciatore D. G	Introduction to Mechatronics and Measurement systems	Tata McGraw Hill Publishing
3	HMT	Mechatronics	Tata McGraw Hill Publishing
4	Mahalik N.P.	Mechtronics principles, concepts and applications	Tata McGraw Hill Publishing
5	Singh, Joshi	Mechatronics	Prentice-Hall India
6	NIIT	Programmable Logic Control	Prentice-Hall India
7	R.K. Mittal & I.J. Nagrath	Robotics & Control	TMH Publications
8	Yoram Korean	Robotics for engineers - Yoram Korean-	McGrew Hill Co.
9	K.S.Fu, R.C.Gonzalex, C.S.G.Lee	Robotics Control Sensing, Vision and Intelligence - -	McGrew hill Book co. -.
10	A.S. Hall	Kinematics and Linkage Design -	Prentice Hal

b) Learning Websites

1) https://www.youtube.com/watch?v=Jwdsz6Sz_f0
2) https://www.youtube.com/watch?v=EgAtcbld1VQ
3) https://www.youtube.com/watch?v=aTgtyY_NXq8
4) https://www.youtube.com/watch?v=JD7LF6ybkWQ
5) https://www.youtube.com/watch?v=S7z3DQiOWOQ&list=RDCMUCnwpEDub-SVH_2TwtkkLZIw&index=2
6) https://www.youtube.com/watch?v=4lilX8cHDHI&t=26s
7) https://www.youtube.com/watch?v=LHn7O6PUaoY
8) https://www.youtube.com/watch?v=_ZztDN5XX5o
9) https://www.youtube.com/watch?v=XxAhrF7KZuE
10) https://www.youtube.com/watch?v=sojj0O8AHRs
11) https://www.youtube.com/watch?v=CWulQ1ZSE3c&t=6s
12) https://www.youtube.com/watch?v=oPq6c-48528
13) https://www.youtube.com/watch?v=CWulQ1ZSE3c&list=RDCMUCbsfyGlrjrKQC0gbzK0-EiA&start_radio=1&rv=CWulQ1ZSE3c&t=66
14) https://www.youtube.com/watch?v=yEU_PNSePbQ
15) https://www.youtube.com/watch?v=YBJclJeg_2Y
16) https://www.youtube.com/watch?v=4bLahdTUS_8
17) https://www.youtube.com/watch?v=B32L9tCarmI
18) https://www.youtube.com/watch?v=eyqwLiowZiU
19) https://www.youtube.com/watch?v=bXXL-0sf8gs&t=3s
20) https://www.youtube.com/watch?v=rYWJdZ5qg6M&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_

21) https://www.youtube.com/watch?v=xrwz9IxpMJg&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=2
22) https://www.youtube.com/watch?v=j8vYClEnyk0&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=3
23) https://www.youtube.com/watch?v=o0NLi-wJS1I&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=4
24) https://www.youtube.com/watch?v=Ra-R0ZCdkPc&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=6
25) https://www.youtube.com/watch?v=MH26PuRNMXM&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=5
26) https://www.youtube.com/watch?v=nLRoK6Hyj0w&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=9
27) https://www.youtube.com/watch?v=KMqWSypAuEg&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=8
28) https://nptel.ac.in/courses/112/103/112103174/
29)) https://www.youtube.com/watch?v=zVVITxiec7g
30) https://www.youtube.com/watch?v=zVVITxiec7g&list=RDCMUCY-ANi3wxkUSGhAel7T0TGw&index=1
31) https://www.youtube.com/watch?v=l1rjErRvbgw
32) https://www.youtube.com/watch?v=8lCTkf-qjA0&list=PLbRMhDVUMngcdUbBySzyzcPiFTYWr4rV_&index=7

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COURSE ID: ME

Course Name : MARKETING MANAGEMENT
Course Code : MEG416
Course Abbreviation : GMGM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : NIL

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks for each practical ii) One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I- Internal Assessment

2. RATIONALE:

This subject deals with marketing aspect of an industry. Market planning or development is the most important part of any organization. There should be market for any product which is produced. This is of prime importance from profit of the industry and running or any industry. In the increasing competition various technical services are being marketed as well as in product design various inputs from marketing should be taken into product design various inputs from marketing should be taken into consideration. Thus, marketing has become a technical job and numbers of students are entering this field.

3. COMPETENCY:

Apply marketing strategies, tools and procedures for achieving desired product sale.

a) Cognitive : Understand marketing strategies, tools and procedures

b) Psychomotor: Prepare market survey and marketing strategies

c) Affective : Attitude of using i) Procedures ii) Practices iii) Tools iv) Techniques for marketing management

4. COURSE OUTCOMES:

MEG416.1 Assess market opportunities by analyzing customers, competitors, collaborators, considering strengths and weaknesses of a company.

MEG416.2 Develop effective marketing strategies to achieve organizational objectives.

MEG416.3 Plan a strategy implementation program to maximize its chance of success over competing industries.

MEG416.4 Apply various innovative ideas of advertisement for enhancing the sales and diversification in product marketing strategies.

MEG416.5 Use various tools/techniques of Market research, product promotion and sales forecast.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline knowledge	**PO 2 Problem Analysis**	**PO 3 Design / development of solutions**	**PO 4 Engineering Tools, experimentation and Testing**	**PO 5 Engineering Practices for Society, Sustainability and Environment**	**PO 6 Project management**	**PO 7 Lifelong learning**	**PSO1 Work in mfg & service sector**	**PSO 2 Start entrepreneurial activity**
Competency	1	2	2	-	-	2	3	2	2
MEG416-1	1	1	1	-	-	1	3	2	2
MEG416-2	1	1	1	-	-	2	3	2	2
MEG416-3	1	2	1	-	-	2	3	2	2
MEG416-4	1	2	2	-	-	1	2	2	3
MEG416-5	1	2	2	-	-	2	3	2	3

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No.	Laboratory experience	Skills developed	Course outcomes
1	Select a product for manufacturing and carry out survey in market.	Assess market opportunities	**MEG416-1**
2	Prepare organizational structure for marketing for selected product.	Organizing marketing in area under consideration.	**MEG416-1**
3	Carry out research in market for selected product.	Analysis of market to study competitors	**MEG416-2**
4	Carry out market segmentation for detailed study w.r.t. selected product.	Carry out market segmentation	**MEG416-2**
5	Prepare marketing strategy for selected product.	Prepare marketing strategy	**MEG416-3**

6	Carry out cost analysis w.r.t. marketing expenses for selected product	Estimation of marketing expenses	**MEG416-3**
7	Carry out consumer analysis w.r.t. above product.	Carry out consumer analysis	**MEG416-4**
8	Prepare a complete report of marketing for above product.	Prepare marketing report	**MEG416-5**

b) Micro-project:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. students will collect data from nearby industries (field visits/online) and prepare
b. students will collect data from nearby industries (field visits/online) and calculate
c. student will study the significance of by visiting industry.
d. Case study

Evaluation shall be of 25 marks and marks should be added in Proforma-IV

B. INDUSTRIAL EXPOSURE:

Included in experiment no. 8 and micro-project

C. THEORY:

SECTION I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG416.1 *Assess market opportunities by analyzing customers, competitors, collaborators, considering strengths and weaknesses of a company.*			
1.	**MARKETING CONCEPTS** 1.1 Marketing function and concepts of marketing 1.2 Approaches to study of marketing 1.3 Management orientation 1.4 Process of marketing, product, pricing, promotion, physical distribution	**06**	**08**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG416.1 *Assess market opportunities by analyzing customers, competitors, collaborators, considering strengths and weaknesses of a company.*			
2.	**MARKETING ORGANIZATION** 2.1 Marketing organization 2.2 Marketing and Customer Service-Customer Satisfaction 2.3 Environmental Variables-Market Planning- Buyer behavior Study 2.4 Stages in Buying Process 2.5 Marketing concept Vs Selling Concept 2.6 Duties and responsibilities at different levels 2.7 Career alternatives in marketing	**08**	**12**
MEG416.2 *Develop effective marketing strategies to achieve organizational objectives.*			
3.	**MARKETING ENVIRONMENT AND RESEARCH** 3.1 Marketing environmental scanning for different industries/business in Indian context 3.2 Introduction to marketing research-Necessity, Classification 3.3 Product Analysis, Market Analysis, Competition Analysis 3.4 Market Research Techniques, Function, Characteristics	**06**	**12**
MEG416.3 *Plan a strategy implementation program to maximize its chance of success over competing industries.*			
4.	**MARKET SEGMENTATION** 4.1 Market segmentation 4.2 Consumer, behaviors, types of markets, industrial, rural, government purchases 4.3 Services and marketing	**04**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic are one and half times the marks allotted above. Candidate can attempt questions for the above allotted marks.			

SECTION II			
Sr. No	**Topics**	**Lectures (Hours)**	**Theory evaluation Marks**
MEG416.2 *Develop effective marketing strategies to achieve organizational objectives.*			
5.	**MARKETING STRATEGY** 5.1 Marketing strategy formulations 5.2 Marketing planning 5.3 Analyzing Competitors, Competitive strategies 5.4 Identifying Market Segments and Selecting Target Market Differentiating and Positioning Market Offering	**04**	**08**
MEG416.3 *Plan a strategy implementation program to maximize its chance of success over competing industries.*			
6.	**MARKETING DECISIONS AND MARKETING CONTROL** 6.1 Product life cycle-Pricing 6.2 New product decisions 6.3 Branding, packaging, pricing decisions 6.4 Distribution and communication decisions 6.5 Marketing Management Process 6.6 Marketing Information System 6.7 Marketing control 6.8 Budgeting, Marketing Audits 6.9 Use of marketing ratios	**06**	**10**
MEG416.4 *Apply various innovative ideas of advertisement for enhancing the sales and diversification in product marketing strategies.*			
7.	**CONSUMER BEHAVIOUR AND MARKET PROMOTION** 7.1 Factors affecting Buyer behavior 7.2 Consumer needs, Consumer Perception-Learning, 7.3 Consumer Attitudes-Communication and Pursuation 7.4 Influence of Culture-Consumer Decision making process: Opinion, Leadership, Attracting and retaining Customers 7.5 Market Promotion-Advertising, Press relations, Communication Customer Relation-Stockholder Relations-Employee relation Public Relations	**06**	**10**
MEG416.5 *Use various tools/techniques of Market research, product promotion and sales forecast.*			
8.	**SALES AND SALES FORECASTING** 8.1 Staff and Function of Sales Department 8.2 Distribution Channel 8.3 Marketing Intermediaries 8.4 Packaging-Packaging Materials 8.5 Sales forecasting-Importance-Types of forecasting, Methods used for forecasting 8.6 Survey of Buyer views, Collective opinion, Sales analysis, 8.7 Elements of good Forecasting –Procedure for Forecasting 8.8 Selection and Evaluation of Forecast 8.9 Uses of Forecast-Statistical Data helpful in Forecasting	**08**	**12**

	Total	24	40
Semester end exam question paper should be such that total marks of questions on each topic are one and half times the marks allotted above. Candidate can attempt questions for the above allotted marks.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION

Section / Topic no.	Name of topic	Distribution of marks			Total marks
		Knowledge	Comprehension	Application	
I/1	Marketing concepts	04	04	--	**08**
I/2	Marketing organization	06	02	04	**12**
I/3	Marketing environment	04	04	04	**12**
I/4	Market segmentation	04	04	--	**08**
II/5	Marketing strategy	02	04	02	**08**
II/6	Marketing decisions and Marketing control	02	04	04	**10**
II/7	Consumer Behavior and Market Promotion	02	04	04	**10**
II/8	Sales and Sales forecasting	04	04	04	**12**
TOTAL		**28**	**30**	**22**	**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND ORAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-IV*.

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-IV*.

b) Term-end Oral Examination (Internal):

Term-end Oral Examination (Internal) shall be conducted as per the following criteria and marks to be added in *Proforma-IV*:

Sr. No.	Criteria	Marks allotted
1	Attendance at regular practical	4
2	Preparedness for practical	4
3	Correct figures / diagrams	6
4	Observation tables	3
5	Result table / calculations / graphs	6
6	Safety / use of proper tools	2
Total		**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Method

i) Lectures and discussions.
ii) Laboratory experiences and laboratory interactive sessions.
iii) Time bound assignments.

Teaching and Learning resources, including references:

i) Chalk-board.
ii) Demonstrative kits.
iii) Demonstrative charts.

10. REFERENCE MATERIAL:

a) Books / Journals

Sr. No.	Author	Title	Publisher
1.	Phillip Kolter	Marketing Management – Analysis Planning and control Sales Management.	Tata Mc. Graw Hills.
2.	Cunliffe L. Blooing	Sales Management Decision, Policies and Cases.	Prentice Hall, Publications.
3.	R.R. Still, E.W. Condiff, N.A. P. Govoni	Modern Marketing Management.	Tata Mc. Graw Hills.
4.	Rustom Davar	Fundamentals of Marketing.	S. Chand, Publications
5.	Stanton	Marketing, A Management Introduction Marketing.	Prentice Hall, Publications
6	Gandhi	Marketing Management	S. Chand, Publications
7	Borce,Joseph Guiltinan	Selling Principles & Practices	Khanna Publications.
8	B. Riuchard	Marketing Management	Tata Mc. Graw Hills.
9	Dholakia, Bhandari & Khurana McCarthy.	Basic marketing – A Managerial Approach.	Prentice Hall, Publications.
10	Banga, Sharma	Industrial Organization and Engineering Economics	Khanna Publishers

b) Websites:

i) http://www.business-standard.com/
ii) http://studymarketing.org/
iii) http://salesandmarketing.com/

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COURSE ID: ME

Course Name : EMERGING TRENDS IN MECHANICAL ENGINEERING
Course Code : MEG417
Course Abbreviation: GETM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I – Internal Assessment

2. RATIONALE:

Over the coming years, technological developments such as Robotics, IOT, Artificial intelligence, smart controls are likely to have a significant impact on the world of work and employment as well as to trigger far reaching changes. Looking towards the era in Technology advancement, Mechanical/Automobile/Production Engineering offers addition of new Dynamic subjects and new versions of core subjects. Diploma Mechanical/Automobile/Production Engineers should be familiar with new technologies from the fields of Automobile Engineering, Energy Management, Advanced Manufacturing Processes, Agriculture and Farm Machines and many more. This Dynamic course will give insight to the recent practices adopted by the Mechanical Industries and awareness of these techniques will enhance career opportunities of Diploma Mechanical/Automobile/Production Engineers.

3. COMPETENCY:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Relate basic principles of Mechanical Engineering with Recent Technologies available in Industry.

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

4. COURSE OUTCOMES:

MEGETM417.1 Identify different new Systems available in Automobile.
MEGETM417.2 Identify different new techniques available in solar and wind energy.
MEGETM417.3 Cite examples of Modern manufacturing Technology in industry
MEGETM417.4 Use of Industry 4.0
MEGETM417.5 Select recent agricultural equipment for pre and post harvesting.
MEGETM417.6 Identify different New Systems available in cryogenic engineering.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency:	2	3	3	2	3	-	3	3	2
MEG315-1	2	1	2	2	-	2	3	3	2
MEG315-2	3	1	1	3	1	-	3	3	3
MEG315-3	2	3	2	3	-	2	3	3	2
MEG315-4	3	3	2	3	1	-	3	3	1
MEG315-5	2	3	2	3	-	-	3	2	1
MEG315-6	3	3	2	3	-	-	3	2	2

6. CONTENT:

A) Continuous Assessment (CA):

Practical Exercises and related skills to be developed:

a) The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No.	Laboratory experience	Skills developed	Course outcome
1.	Visit to automobile battery manufacturing company.	Able to observe various components of battery understand function of each component, their constructional details & working	MEG417.1
2.	Visit to solar and wind power plant	Able to observe various components of solar and wind power plant, understand function of each component, their constructional details.	MEG417.1
3.	Visit to automation device manufacturing industry	Able to observe various components of automation, understand function of each component, their constructional details.	MEG417.2
4.	Visit to smart factory.	Able to observe various components of smart factory, understand function of each component, their constructional details.	MEG417.2

5.	Agriculture Equipment and post-harvest Technology	Survey of Agriculture Equipment and post-harvest Technology in your area	MEG417.2
6.	Visit to Cryogenics oxygen plant	Able to observe various components of Cryogenics oxygen plant, understand function of each component, their constructional details.	MEG417.3

b) **Micro-project**:

A list of microproject is given below:

1. Title-Advances in Automobile Engineering such as MPFI, TPFC, VTEC, Use of microprocessor.
2. Automobile fuels such as ethanol, biodiesel, Battery, solar, etc.

Form a Group of 4 students in a batch.

B. INDUSTRIAL EXPOSURE:

a) As per practical no. 2 expert lectures by prominent personalities from industries.
b) As per practical no. 8 an Industrial visit of students to service station.

C. THEORY:

SECTION-I

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
*Course Outcome MEGETM***417.1** Identify different New Systems available in Automobile.			
1.	**Recent Trends in Automobile Industry** 1.1 Hybrid cars-manufactures, Types- Micro Hybrid, Mild Hybrid, Full Hybrid, Series hybrid, Parallel Hybrid 1.2 E-vehicles- Manufacturers, specifications, Types of Li-ion batteries, Sodium, Chloride Batteries, Sodium Sulphur Batteries, Fuel Cell, Charging- Charging Methods and Modes. Issues with **e-vehicles**	**08**	**14**
Course Outcome **MEGETM417.2** Apply Heat engineering principles in process Boilers and waste heat Recovery systems used in Process Industry			
2	**Solar and Wind Technology** 2.1 Floating solar farms 2.3 BIPV solar technology 2.4 Solar skins 2.5 Solar fabric. 2.6. Airborne wind energy. 2.7. Offshore floating wind concepts. 2.8. Smart rotors. 2.9. Wind turbine with tip-rotors. 2.10 Multi-rotor wind turbines.	**08**	**10**

***Course Outcome MEGETM*417.3** Cite examples of Modern manufacturing Technology in industry			
3.	**Recent Trends in Manufacturing in industry** 3.1 **Automation:** Need, Basic elements of automated systems, Automation principles and strategies, Benefits. 3.2 Types of automation: fixed, programmable, flexible, hard and soft automation. 3.3 4-D printing Technology- Printing Techniques 3D scanning Technology- Function, Applications	**08**	**16**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	**Topics/Sub-topic**	**Teaching (Hours)**	**Theory Evaluation Marks**
Course Outcome **MEGETM417.4** Use different coating system in industry.			
4	**Industry 4.0** 4.1 Origins and history of Industry 4.0 4.2 Integrations in Industry 4.0: vertical and horizontal 4.3 Industrial IoT platform 4.4 Smart Manufacturing 4.5 Benefits of Adopting an Industry 4.0 Model 4.6 Industry 4.0 applications	**08**	**14**
***Course Outcome MEGETM*417.5** Select recent agricultural equipment for pre and post harvesting.			
5	**Agriculture Equipment and post-harvest Technology** 5.1 Tillers, Sowing and planting equipment, Weeding Machines, Spraying Machines, Harvesting, Post harvesting Machineries 5.2 Elements of Cold chain 5.3 National Cooling Action Plan (NCAP)	**08**	**16**
Course Outcome **MEGETM417.6** Identify different New Systems available in cryogenic engineering.			
6	**Cryogenics Engineering** 6.1 Properties of cryogenic 6.2 Air liquefaction 6.3 Cryogenic engines 6.4 Cryo pump 6.5 Cryocoolers 6.7 Cryogenic storage systems 6.8 Industrial applications	**08**	**10**
	TOTAL	**24**	**40**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Course outcome	Total marks
		Knowledge	Comprehension	Appli-cation		
I/1.	Recent Trends in Automobile Industry	04	02	-	MEG417.1	06
I/2.	Advance in thermal engineering.	04	08	08	MEG417.2	20
I/3.	Recent Trends in Manufacturing in industry	02	06	06	MEG417.3	14
II/4.	Industrial Coating	04	04	04	MEG417.4	12
II/5.	Agriculture Equipment and post-harvest Technology	04	04	04	MEG417.5	12
II/6.	Cryogenics Engineering	04	06	06	MEG417.6	16
				TOTAL		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. CONTINUOUS ASSESSMENT CRITERIA

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-IV*.

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-IV*.

b) Term-end Oral Examination (Internal):

Term-end Oral Examination (Internal) shall be conducted by Internal, internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-IV*:

Sr. No.	Criteria	Marks allotted
1	Preparedness for practical	05
2	Correct figures / diagrams	05
3	Observation tables	05
4	Result table / calculations / graphs	05
5	Safety / use of proper tools	05
	Total	**25**

10. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions
ii) Classroom practices
iii) Laboratory experiences and laboratory interactive sessions
iv) Experiences and discussions through industrial visits
v) Time bound assignments

Teaching and Learning resources:

i) Chalk board
ii) Demonstrative kits
iii) Demonstrative charts
iv) LCD presentations
v) Audio presentations
vi) Item Bank

11. REFERENCE MATERIAL:

a) Books

Sr. No.	Title	Author name
1	Automobile engg. vol I & II	Kirpal singh
2	The Motor Vehicle	Newton Garrett.
3	Automobile Engg.	K.K.Jain & R.B. Asthana.
4	A Textbook of Thermal Engineering: Mechanical Technology	S Chand
5	Powder Coating Technology First Edition	Charles I. Hester
6	Cryogenic Engineering	Thomas M Flynn
7	Engineering Principles of Agricultural Machines	Ajit K. Srivastava

b) Websites

i) http://chemwiki.ucdavis.edu
ii) http://en.wikipedia.org

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COURSE ID: **ME**

Course Name : TOTAL QUALITY MANAGEMENT
Course Code : MEG418
Course Abbreviation : GTQM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks for each practical ii) One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I- Internal Assessment

2. RATIONALE:

In spite of great development in machine tool technology it becomes necessary to confirm the variation in dimensions of the work pieces. This is because the change in dimension may occur due to variation in 3Ms- Man, Machine & Material. Variation in 3MS directly of the work piece. The variation in dimensions from the given tolerance of the machine part of work piece affects on the performance of that machine. Confirmation of the variation in dimensions can be achieved by collecting data & by using different statistical methods, which further helps control on variation in manufacturing process & of quality of product.

3. COMPETENCY:

Apply quality system tools and procedures for achieving desired product quality.

Cognitive : Understand quality system tools and procedures
Psychomotor: Prepare control charts for analyzing manufacturing process.
Affective : Attitude of using i) Procedures ii) Practices iii) Tools iv) Techniques for quality improvement

4. COURSE OUTCOMES:

MEG418.1- Recognize the quality procedures and parameters for customer satisfaction.
MEG418.2- Identify the practices of quality assurance and economics in an organization.
MEG418.3- Prepare and apply statistical quality tools for regulating the manufacturing process.
MEG418.4- Describe the concepts of total quality management (TQM)
MEG418.5- Use tools and techniques for TQM.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline knowledge	**PO 2 Problem Analysis**	**PO 3 Design / development of solutions**	**PO 4 Engineering Tools, experimentation and Testing**	**PO 5 Engineering Practices for Society, Sustainability and Environment**	**PO 6 Project management**	**PO 7 Lifelong learning**	**PSO1 Work in mfg & service sector**	**PSO 2 Start entrepreneurial activity**
Competency	3	3	2	1	1	2	3	3	1
MEG418-1	2	2	1	-	-	1	3	3	2
MEG418-2	2	3	1	-	-	2	3	1	-
MEG418-3	3	3	1	-	-	2	3	3	2
MEG418-4	3	1	2	-	-	1	2	2	3
MEG418-5	3	2	2	1	-	2	3	3	3

6. CONTENT:

A) Continuous Assessment (CA):

Practical Exercises and related skills to be developed:

a) The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No.	Laboratory experience	Skills developed	Course outcomes
1.	Preparation of Histogram and calculation of standard deviation.	Student will get familiar to apply quality control techniques for the analysis of process.	MEG418.3
2.	Preparation of X bar and R Chart.	Student will get familiar to apply quality control techniques for the analysis of process.	MEG418.3
3.	Preparation of 'p' and 'c' Chart.	Student will get familiar to apply quality control techniques for the analysis of process	MEG418.3
4.	Case study on Process Capability	Students will calculate process capability of a machine.	MEG418.3
5.	Study of ISO9000 series.	To know significance of ISO9000.	MEG418.5
6	Case study of Kaizen	To develop skills in Quality Techniques	MEG418.4
7	Case study of Six Sigma	To develop skills in Quality Techniques	MEG418.5
8.	Visit to industry to study Quality Tools and Techniques	Students will learn hands on experience.	MEG418.3

b) Micro-project:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Quality control techniques for the analysis of process: students will collect data from nearby industries (field visits/online) and prepare histogram, X bar and R chart, 'p' and 'c' Chart, calculate standard deviation (whichever applicable) etc.
b. process capability of a machine: students will collect data from nearby industries (Field visits/online) and calculate process capability of a machine.
c. ISO9000 series: student will study the significance of ISO9000 by visiting industry.
d. Case study on TQM techniques.: Kaizen, Six Sigma, Poka Yoka etc.

Evaluation shall be of 25 marks and marks should be added in Proforma-III

B. INDUSTRIAL EXPOSURE:

Included in experiment no. 8 and micro-project

C. THEORY:

Section-I

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
MEG418.1- *Recognize the quality procedures and parameters for customer satisfaction.*			
1	**INTRODUCTION TO QUALITY CONTROL** 1.1 Definition & concept of Quality. 1.2 Inspection – concept, need, planning, difference between inspection & quality control 1.3 Quality of design, quality of conformance, & Quality policies. 1.4 Concept of reliability & maintainability. 1.5 Role of management & suppliers to ensure quality of the product.	**09**	**16**
MEG418.2*- Identify the practices of quality assurance and economics in an organization*			
2	**QUALITY ASSURANCE** 2.1 Concept of Quality Assurance. 2.2 Responsibilities of quality assurance. 2.3 Quality audit. 2.4 Quality circles, concept, purpose & function.	**09**	**14**
MEG418.2*- Identify the practices of quality assurance and economics in an organization*			
3	**QUALITY ECONOMICS** 3.1 Cost of quality, value of quality & balance between the two. 3.2 Economics of quality design & quality of conformance 3.3Cost of quality: Appraisal, Prevention, External & Internal failure cost.	**06**	**10**

Section-II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
MEG418.3*- Prepare and apply statistical quality tools for regulating the manufacturing process.*			
4.	**STATISTICAL QUALITY CONTROL** 4.1 Meaning and importance of SQC 4.2 Meaning of frequency distribution, mean, mode, median standard deviation, 4.3 Normal distribution curve, Area under the curve & its interpretation. 4.4 Control charts for variables X & R charts 4.5 Process capability Analysis	**08**	**12**
MEG418.4*- Describe the concepts of total quality management (TQM)*			
5.	**TOTAL QUALITY MANAGEMENT(TQM)** 5.1 TQM Definition & Basic Concepts 5.2 Deming philosophy of TQM	**08**	**14**

	5.3 Characteristics of Quality Leaders. 5.4 Quality Council 5.5 Quality statements: Vision, Mission, Quality Policy 5.6 Characteristics of successful Teams 5.7 Continuous Process Improvement: Juran Triology, Kaizen, PDSA Cycle, Poka Yoka		
***MEG418.5**- Use tools and techniques for TQM.*			
6.	**TQM: TOOLS AND TECHNIQUES** 6.1 Seven tools of TQM: Pareto Diagram, Process Flow diagram, Cause and Effect (ISHIKAWA)Diagram, Check sheet, Histogram, Control Chart, Scatter Diagram 6.2 Benchmarking: Definition, Purpose of Benchmarking 6.3 Six Sigma: Principle and application 6.4 Theory of 5 s. 6.5 ISO: Benefits of ISO, ISO 9000 Series of standards, ISO 14000 Series of Standards	**08**	**14**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic No.	Name of topic	Distribution of marks (level wise)			Course outcomes	Total marks
		Knowledge	Comprehension	Application		
I/1	Introduction to Quality Control.	04	08	04	MEG418.1	16
I/2	Quality Assurance.	05	05	04	MEG418.2	14
I/3	Quality Economics.	06	04	--	MEG418.2	10
II/4	Statistical Quality Control.	04	04	04	MEG418.3	12
II/5	TQM	04	04	06	MEG418.4	14
II/6	TQM Tools & Techniques.	04	04	06	MEG418.5	14
Total		**27**	**29**	**24**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND ORAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-IV*.

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-IV*.

b) Term-end Oral Examination (Internal):

Term-end Oral Examination (Internal) shall be conducted as per the following criteria and marks to be added in *Proforma-IV*:

Sr. No.	Criteria	Marks allotted
1	Preparedness for practical	5
2	Correct figures / diagrams	5
3	Observation tables	6
4	Result table / calculations / graphs	4
6	Safety / use of proper tools	5
		25

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions.
ii) Laboratory experiences and laboratory interactive sessions.
iii) Time bound assignments.

Teaching and Learning resources, including references:

i) Chalk-board.
ii) Demonstrative kits.
iii) Demonstrative charts.

10. REFERENCE MATERIAL:

a) Books:

Sr. No	Author	Title	Publisher
1	R.C. GUPTA	Statistical quality control	Tata Mc Graw Hill.
2	Grant	Statistical quality control	New Age Publication.
3	Ed. Robert Peach	ISO9000 Hand book	Tata Mc Graw Hill.
4	Furan & Grayna	Quality control	Prentice Hall Publication.

* * *

LEVEL - V

MANAGEMENT AND DIVERSIFIED TECHNOLOGY COURSES

COURSE ID: ME

Course Name : ENTREPRENEURSHIP DEVELOPMENT
Course Code : CCG501
Course Abbreviation: GESU

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	02	04
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	--	As per Proforma-IV	
Marks	**--**	As per Proforma-IV	**--**	**50 I**	**50**

I– Internal Examination

2. RATIONALE:

Globalization, liberalization and Privatization along with revolution in information technology have opened up new opportunities transforming lives of masses. In this context, there is an immense opportunity of establishing manufacturing, service, trading, marketing and consultancy enterprises by diploma engineer, our fast-growing economy provides ample scope for diploma engineers to succeed as an entrepreneur. Entrepreneurship requires distinct skill sets which are attempted to be developed through this course. To begin with, this course aims to develop the competency and the related outcomes in order to start small enterprises.

3. COMPETENCY:

The aim of this course is helping the students to attain the following industry identified competency through various teaching & learning experiences:

a) Cognitive : i) Understanding and applying principles and labour laws ii) Observing iii) Classifying iv) Interpreting

b) Psychomotor: Man power handling.

c) Affective : i) Follow the safe practices, ii) Practice good housekeeping iii) Maintain tool and equipment

4. COURSE OUTCOMES:

CCG501-1: Identify your entrepreneurial attributes
CCG501-2: Identify the business opportunities that suits you
CCG501-3: Use the support systems to zero down to your business idea.
CCG501-4: Develop comprehensive business plans.
CCG501-5: Prepare plans to manage the enterprise effectively.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and Discipline Specific knowledge	PO 2 Problem Analysis	PO 3 Design / Development of solution	PO 4 Engineering Tools, Experimentation and Testing	PO 5 The engineering Practices for society, Sustainability and environment	PO 6 Project Management	PO 7 Life-long Learning	PSO 1 Working Mfg. & Service sector	PSO 2 Start entrepreneurial activity
Competency:	-	-	-	-	-	-	-	-	-
CCG501-1	-	-	-	-	-	-	-	-	-
CCG501-2	-	-	-	-	-	-	-	-	-
CCG501-3	-	-	-	-	-	-	-	-	-
CCG501-4	-	-	-	-	-	-	-	-	-
CCG501-5	-	-	-	-	-	-	-	-	-

6. CONTENT:

A) PRACTICLAS / EXERCISES:

The practicals in these sections are the sub components of the COs to be developed and assessed in the students for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit Nos.	Approx Hrs. Required
1	Submit a profile summary (about 500 words) of a successful entrepreneur indicating milestone achievement.	I	02*
2	Undertaking SWOC analysis to arrive at your business idea of a product / service.	I	02
3	General business ideas (product / service) for intrapreneurial and entrepreneurial opportunities through brainstorming.	II	02
4	Undertake self-assessment test to discover your entrepreneurial opportunities.	II	02*
5	Identify business opportunities/self-employments areas suitable for you.	II	02
6	Survey industries of your stream; grade them according to the level of scale of production, investment, turnover, pollution to prepare a report on it.	II	02
7	Visit a bank/Financial institution to enquire about various funding schemes for small scale enterprise.	III	02*

8	Collect loan application forms of national banks/other financial institutions.	III	02*
9	Compile the information from financial agencies that will help you set up your business enterprise.	III	02*
10	Compile the information from government agencies that will help you set up your business enterprise.	III	02*
11	Prepare Technological feasibility report of a chosen product/service.	III	02*
12	Prepare a set of short term, medium and long term goals for starting a chosen small-scale enterprise.	III	02*
13	Prepare marketing strategy for your chosen product/service.	IV	02*
14	Compile the information about insurance schemes covering different risk factors.	IV	02
15	Find the breakeven point for the business idea chosen by you.	V	02
16	Prepare a business plan for your chosen small scale enterprise.	V	02*
17.	Organize funfair for your class and write report of profit/loss.	V	02
18.	Visit report of any industry: Brief history, types and details of services/support assistance being given, any other information which is useful to self-employer/entrepreneur.	V	02

Note: A judicial mix of minimum 12 or more practical need to be performed, out of which, the Practical's marked as '*' are compulsory, so that the student reaches the 'Precision Level of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

The above practical Outcomes also comprise the following social skills/attitudes which are Affective Domain Outcomes that are best developed through the laboratory/field based experiences:

a. Follow safe practices
b. Good housekeeping practices
c. Practice energy conservation
d. Demonstrate working as a leader/a team member
e. Maintain tools and equipments
f. Follow ethical practices

The Affective Domain Outcomes are not specific to any one Practical Outcomes, but are embedded in many Practical Outcomes. Hence, the acquisition of the Affective Domain Outcomes takes place gradually in the students when he/she undertake a series of practical experiences over a period of time.

B) THEORY:

Sr. No	Topics / Sub-topics	Lectures (Hours)
1	**Entrepreneurship Development- Concept and Scope** 1.1 Concepts and Overview of Entrepreneurship. Evolution and Growth of Entrepreneurship in India. Role of Entrepreneurship in Economic Development. Entrepreneurship as a career. 1.2 Traits of successful intrapreneur / entrepreneur: Consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, 1.3 Entrepreneurship: Scope in local and global market. 1.4 Intrapreneur and entrepreneur. 1.5 Types of enterprises and their features: Manufacturing, Service and trading. 1.6 Steps in Setting up of a business	**06**
2	**Entrepreneurial Opportunities and Selection Process:** 2.1 Product / Service selection: Process, core competence, product / service life cycle, new product / service development process, mortality curve, Creativity and innovation in product / Service modification / development. 2.2 Process selection: Technology life cycle, forms and cost of transformation, Factors affecting process selection, Location for an industry, Material handling. 2.3 Market study procedures: Questionnaire design, sampling, Market survey, Data analysis 2.4 Getting information from concerned stake holders such as Maharashtra Centre for Entrepreneurship Development (MCED), National Institute for Micro, Small and Medium Enterprises (NI-MSME, Prime Minister Employment Generation Program (PMEGP), Directorate of Industries (DI), Khadi Village Industries Commission (KVIC).	08
3	**Support Systems:** 3.1 Categorization of MSME, Ancillary Industries. 3.2 Support System-Government Agencies: MCED, NI- MSME, PMEGP, DI, KVIC. 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consolation, technology transfer and quality control, marketing and finance 3.4 Breakeven point, return of investment and return on sales.	**06**

Sr. No	Topics / Sub-topics	Lectures (Hours)
4	**Business plan preparation:** 4.1 Sources of Product for Business: Feasibility study. 4.2 Ownership, Capital, Budgeting, Matching Entrepreneur with the project, Feasibility report preparation and evaluation criteria. 4.3 Business plan preparation.	06
5	**Managing Enterprise:** 5.1 Unique Selling proposition (U.S.P.): Identification, Developing a marketing plan. 5.2 Preparing Strategies of handling Business: Policy making, negotiation and bargaining techniques. 5.3 Risk management: [planning for calculated risk taking, initiation with low Cost projects, integrated futuristic planning, angel investors, venture capitalist. 5.4 Incubation centres: Role and procedure.	06

C) MAJOR EQUIPMENTS/INSTRUMENTS REQUIRED:

The major equipment with broad specification mentioned here will user in uniformity in conduct of experiments, as well as aid to procedure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Seminar Hall equipped with conference table, chairs and multimedia facilities.	All
2	Modern Desktop Computer with internet connection.	All

D) SUGGESTED STUDENT ACTIVITY –Under Micro-Project

Other than the classroom and laboratory learning, following are the suggested student related Co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare report of about 5 pages for each activity, also collect/record physical evident for their (student's) portfolio which will be useful for their placement interviews:

a. Download product development and innovative films from internet.
b. Prepare collage for "Traits of Successful entrepreneurs"
c. Identify your hobbies and interests and convert them into business idea.
d. Convert your project work into business.
e. Decide any product and analyze its good and bad features.
f. Choose any product and study its supply chain.
g. Visit industry exhibitions, trade fairs and observe nitty-gritty of business.
h. Perform a survey and identify local resources available for setting up of an enterprise.
i. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, competitor's product price, features, dealer commissions, and marketing mix.
j. Prepare a business plan and organize a business plan competition.

7. PERFORMANCE INDICATOR: -

Sr. No.	Performance Indicators	Weightage in %
1	Leadership Skills	20
2	Team Work	20
3	Lateral / Creative Thinking	10
4	Observation and Recording	10
5	Self-learning	20
6	Answer the simple questions	10
7	Submission of report on time	10
	Total	**100**

8. SUGGESTED LEARNING RESOURSES

Sr. No.	Title of Books	Author	Publication
1	The entrepreneurial Instinct: How Everyone Has the Innate Ability to Start a Successful Small Business.	Mehta, Monica	McGraw-Hill Education, New Delhi, 2012, ISBN 978-0-07-179742-9
2	Entrepreneurship	Hisrich R. D.	McGraw-Hill Education, New Delhi, 2013, ISBN-13: 978-1259001635
3	Part I Readings in Entrepreneurship Education	Sareen S.B.	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad, 2016; ISBN: 978-0078029169
4	Reading Materials of Entrepreneurship Awareness Camp	Gujral, Raman	Entrepreneurship Development Institute of India (EDI), GOI, Ahmedabad
5	Product Design and manufacturing	Chitale A.K.	PHI Learning, New Delhi,2014; ISBN: 9788120348738
6	Entrepreneurship Development Small Business Entrepreneurship	Charantimath, Poornima	Pearson Education India, New Delhi; ISBN: 9788131762264
7	Entrepreneurship Development: Special Edition for MSBTE	CPSC, Manila	Tata McGraw Hill, New Delhi
8	Entrepreneurship Development Small Business Management	Khanka S. S.	S. Chand and sons, New Delhi, ISBN: 978-93-5161-094-6
9	Entrepreneurship Development	S. Anil Kumar	New Age International, New Delhi, ISBN: 9788122414349

9. SUGESTED SOFTWARE/LEARNING RESOURSES

Sr. No	SOFTWARE/LEARNING RESOURSES	LINKS
1	MCED Book Links	http://www.mced.nic.in/UdyojakSpecial.aspx?linktype=Udyojak
2	MCED Product and Plan Details	http://www.mced.nic.in/allproduct.aspx
3	The national Institute for Entrepreneurship and Small Business Development Publications	http://www.mced.nic.in/Publications.html
4	Courses: The National Institute of Small Business Development Publication	http://niesbud.nic.in/docs/1standardized.pdf
5	Entrepreneur.com	http://www.entrepreneur.com/lists
6	Government sponsored schemes	http://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530
7	NABARD- Information Centre	http://www.nabard.org/Tenders.aspx?cid=501andid=24
8	NABARD – What we do	http://www.nabard.org/content 1.aspx?id=8andcatid=8andmid=488
9	Market Review	http://www.businesstoday.in/markets
10	Start Up India	http://www.startupindia.gov.in/pdffile.php?title=Sartup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action
11	About – Entrepreneurship Development Institute of India (EDII)	http://www.ediindia.org/institute.html
12	EDII –Centres	http://www.ediindia.org/centres.html
13	EDII – Publications	http://www.ediindia.org/publication.html
14	Business Plan: A Step-By-Step Guide	http://www.entrepreneur.com/article/247574
15	The National Science and Technology Entrepreneurship Development Board (NSTEDB)	http://www.nstedb.com/index.html
16	NSTEDB – Training	http://www.nstedb.com/training/training.html
17	Tata Exposures	http://wwwtatasocial-in.com/project-exposure
18	Ministry of Micro, Small and Medium Enterprises	http://www.dcmsme.gov.in/schemes/TEQUPDetail.html
19	List of Business Ideas for Small Scale Industry	http://small.sidbi.in%20/thinking-starting-business/big-list-business-ideas-small-business
20	Thinking of Entrepreneurship	http://smallb.sidbi.in/entrepreneurship-stage/thinking-entrepreneurship
21	List of Service for Small Scale Industry	http://www.archive.india.gov.in/business/Industry_services/illustrative.php
22	NSIC Schemes and Services	http://www.nsic.co.in/SCHSERV.ASP

* * *

COURSE ID: ME

Course Name : INTERNSHIP-I (4 WEEKS)
Course Code : CCG502
Course Abbreviation : GINO

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	--	03
Practical	--	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (External)*	
Details of Evaluation	-	--	--	Term End Practical Exam	
Marks	---	--	---	50 E	50

* Assessment as per scheme given in Table-3 and Table -4, E– External Examination

2. RATIONALE

This Industrial training (internship) is compulsorily introduced for all the diploma programmes to expose the students for a longer period to the industrial environment and develop the relevant good habits of industry culture among the students before they enter the industry. By exposing and interacting with the real-life industrial setting, the students will appreciate and get accustomed to the actual working of an industry along with the best practices adopted by them. The industrial culture skills fall under soft skills, life skills and hands-on which will be inculcated among the students. Such a short exposure will be an effective association with the industry, for the students and will be instrumental in orienting them to be industry ready, to a much greater extent than the present ones, after completion of the respective diploma programme.

2. COMPETENCY

The course is intended to develop the following competencies:

- Soft Skills such as: Communication, Presentation etc.
- Life skills such as: Time management, Safety, Innovation, Entrepreneurship, Team building etc.
- Hands-on skills such as: Design, Implementation, Different operations, Quality Assurance etc.

3. COURSE OUTCOMES:

The industrial training (internship) related competencies as mentioned above to supplement those attained through several courses up to fourth semester of the relevant programme can be achieved by the following course outcomes:

CCG502-1: Communicate effectively (verbal and equally written) the works carried out.

CCG502-2: Prepare and present the report of the works carried out.

CCG502-3: Exercise time management and safety in the work environment.

CCG502-4: Work effectively as a team member.

CCG502-5: Demonstrate various quality assurance skills.

Note: Both ESE and PA part of assessment will be carried out by institute faculty and industry training supervisor as explained in the relevant proforma of assessment.

4. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

a) **Training during the programme:** Between 4th and 5th semester (During Summer Vacation).
b) **Duration of the training:** four weeks
c) **Training Area:** Students should be trained in large and medium scale Industry / Organization. However, despite the best efforts by the institute, if large and medium scale Industry / Organization are not available to all students then, students can also be placed in small scale Industry / Organization.
d) These Industries / Organizations can be Government /Public limited/ or Private family enterprises.

For ***Civil engineering*** it can be public works department, irrigation department, public health engineering, municipal corporations, town and country planning, highway and roads authorities, railways, large and medium scale civil contractors, rural engineering departments, environment corporations, large and medium scale private construction companies, mining companies etc.

For ***Mechanical Engineering*** it can be manufacturing, fabrication, foundry or processing industry which may include compressors, boilers, engines, heat exchangers, air conditioning and refrigeration plants, conveyors etc are either manufactured or used. Power plants, Railways, process plants, ordinance factories, textile factories, automobile manufacturers or major automobile workshops.

For ***Electrical engineering*** it can be electricity transmission and distribution companies, power generating stations, sub stations, railways, industries manufacturing electrical products which may include industry where large motors/transformers etc. are used, process plants, electrical contractors.

For ***Electronic and Industrial Electronics engineering*** it can be telecommunication companies, post and telegraph department, manufacturer of telecommunication product, manufacturers of control equipments, manufacturer of CNC machines, any manufacturing industry where electronic controls are used either in production process or in its products, computer hardware manufacturers, signal divisions of railways, etc.

For ***IT i***ndustries it can be any software developers, cyber security companies, web page developers, networking companies, data base management companies, telecommunication companies or IT division of any other industries/finance/retail companies or organizations where software are used and maintained for various applications.

For **Metallurgical Engineering it** may include documenting the work, operating the lab mixtures, preparation of specimens, Metallographic testing of specimens, assisting the senior engineers etc.

5. ROLE OF PARENT DEPARTMENT OF THE INSTITUTES:

Sr. No	Activity	Schedule
1	Collecting information about Industry / Organization available for training along with capacity (Format - 1)	Before completion of 3rd semester
2	Student and mentor allocation as per the slots available for in-plant training (Desirable mentor-student ratio is 1:15)	Before commencement of 4th semester
3	Communication with Industry / Organization available for training along with capacity and its confirmation	Before first Unit Test of the 4th semester
4	Obtaining consent letter from parents / guardian (Format - 2)	Before second Unit Test of the 4th semester
5	Student enrollment for In-plant training (Format-3)	Before commencement of 4th semester examination
6	Issue letter to the Industry / Organization for the training along with details of students and mentors. (Format - 4)	During 4th semester examination
7	Mentors to carry out progressive assessment of the students during the in-plant training (Format -5)	Each week of training
8	End of training assessment by mentor along with Industry / Organization expert as external examiner (Format - 6)	Before 5th semester ESE

Suggestions:

a) Departments can take help of alumni or present students (if they or their parents or relatives have some contact in different industries) for securing placement.

b) The students would normally be placed as per their choices, in case of more demand for a particular Industry / Organization students would be allocated place based on their relative merit. However, if some students have arranged training placement in some companies with the help of their parents/relatives etc. then they will be given preference for placement in those companies.

c) Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry / Organization during the training before relieving students for training.

d) The faculty member during the visit to Industry / Organization will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.

6. EXPECTATIONS FROM INDUSTRY

Helping the institute in developing the following competencies among students

- **Soft Skills such as: Communication, Presentation etc.**
- **Life skills such as: Time management, Safety, Innovation, Entrepreneurship, Team building etc.**
- **Hands-on skills such as: Design, Implementation, Different operations, Quality Assurance etc.**

7. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

a) Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.

b) Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.

c) He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.

d) Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and sent back the students.

e) It is the responsibility of the student to collect information from Industry / Organization about manufacturing processes / testing and quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/organizational structure etc.

f) During the training period students have to keep record of all the useful information in Log book and maintain the weekly diary as provided and get it signed from mentor as well as Industry / Organization training in-charge.

g) In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.

h) Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

8. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organization. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1. Organizational structure of Industry / Organization and General Lay Out

Chapter 2. Introduction of Industry / Organization (Type of products and services, history, turnover and number of employees etc.)

Chapter 3. Types of major equipment/instruments/ machines used in industry with their specification, approximate cost and specific use and their routine maintenance.

Chapter 4. Manufacturing Processes along with production planning and control methods.

Chapter 5. Testing of raw materials, components and finished products along with quality assurance procedures.

Chapter 6. Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.

Chapter 7. Safety procedures followed and safety gear used (includes Preventive maintenance schedule and breakdown maintenance procedures).

Chapter 8. Particulars of Practical Experiences in Industry / Organization if any in Production/ Assembly/ Testing/Maintenance.

Chapter 9. Short report/description of the project (if any done during the training)

Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

9. REFERENCES /BIBLIOGRAPHY

A) SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and testing manuals used in the industry. Students may also visit websites related to other industries wherein similar products are being manufactured as their learning resource.

B) TENTATIVE WEEK-WISE SCHEDULE OF INDUSTRIAL TRAINING

The industrial training is a common course to all programmes; therefore, the industry / Organization selection will depend upon the nature of programme and its related industry. The training activity may vary according to nature and size of Industry / Organization. The following table details suggestive schedule for industrial training for all programmes.

Table - 2 Detail week schedule and Marks distribution

S. No.	Week No.	Details of activities to be completed during Industrial training	Marks distribution/ week for PA
1	Week No. 1	Induction to industry and its departments	05
		Study of layout and specifications of major machines, equipment and raw materials / components / software used.	05
2	Week No. 2	Study of setup, processes/ milestone project.	05
		Study of QA/QC procedures.	10
		Study safety and maintenance procedure in an industry/organization	
3	Week No. 3	Build a project as per requirements from Industry	10
4	Week No. 4	Report Submission and Completion certificate	05
PA marks to be given by industry supervisor			25
PA marks to be given by polytechnic faculty based on performance			10
Total PA marks for training			**75**

Table - 3 ASSESSMENT SCHEME FOR INDUSTRIAL TRAINING

Training duration	PROGRESSIVE ASSESSMENT (*Weekly report of all 4week and attendance)*		END SEMESTER ASSESSMENT (*Seminar and Oral)*		Total marks	
Seven weeks	Max. marks	Min. marks	Max. marks	Min. marks	Max. marks	Min. marks
	#75	-----	75**	30	150	60

Assessed by Internal examiner

**assessed by external examiner based on report (25 Marks), presentation (25 Marks) and Viva-Voce (25 Marks)

Table - 4 Distribution of End-Semester-Examination (ESE) marks of Industrial Training

Marks for Industrial Training Report	Marks for Seminar/ Presentation	Marks for Oral/Viva-voce	Total ESE marls
25	25	25	75

Format-1 :

Information about Industry/Organisation for training

1) Name of the industry/organization:
2) Address/communication details (incl email):
3) Contact person details:
   a) Name :
   b) Designation :
   c) Email :
   d) Contact number/s:

4) Type:
   Govt / PSU / Pvt /
   Large scale / Medium scale / Small scale …..

5) Products/services offered by industry:

6) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: Yes / No.
   b) If yes, whether you offer 6 weeks training : YES/NO
   c) Internship capacity possible:

Programme	Civil Engg	Mechanical Engg	Electrical Engg	……	Total
Male					
Female					
Total					

7) Whether accommodation available for interns Yes / No.
   If yes capacity:_____

8) Whether internship is charged or free:
   If charged please specify amount per candidate: _____

Signature of responsible person:

Format-2:

Obtaining Consent Letter from parents/guardians

(Undertaking from Parents)

To,

The principal,

_____,

Subject: Consent for Industrial Training.

Sir/Madam,

I am fully aware that -

i) My ward studying in _____ semester at your _____ institute has to undergo six weeks of Industrial training for partial fulfillment towards completion of Diploma in _____ Engineering.

ii) For this fulfillment he/she has been deputed at _____ industry, located at _____ for internship of ____ weeks for the period from _____ to _____.

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

a) My ward will undergo the training at his/her own cost and risk during training and/or stay.
b) My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
c) My ward is NOT entitled to any leave during training period.
d) My ward will submit regularly a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :

Name : _____

Address :_____

_____

Phone Number:_____

Format-3 :

Student enrollment for In-plant training (To be design by programme department)

Sr. No.	Roll No.	Name of Student	Division	Company / Organization Name	Address of Company / Organization

Format-4:

Issue Letter to the Industry/Organisation for the training along with details of students and mentors

To,
The HR Manager,
_____

Subject: Placement for Industrial training of ___ weeks in your organization….
Reference: Your consent letter no: ….

Sir,
With reference to the above we are honoured to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.
Diploma programme in _____ Engg.

Sr. no.	Enrolment no.	Name:	Mentor

Diploma programme in _____ Engg.

Sr. no.	Enrolment no.	Name:	Mentor

Kindly do the needful and oblige.
Thanking you in anticipation

Yours sincerely,

(Principal)
Name of the Institute:
with Seal

Format-5

PA of Internship-I

Academic year: 20 -20

Name of the industry:

Sr. No	Enrolment Number	Name of student	Marks					PA Marks by Industry Supervisor	PA based on Report by mentor faculty	Total
			Week 1 (Out of 10)	Week 2 (Out of 15)	Week 3 (out of 10)	Week 4 (Out of 5)	Total (A) (out of 40)	Out of 25 (B)	Out Of 10 (C)	Out of 75 (A)+(B)+(C)

Marks for PA are to be awarded for each week considering the level of completeness of activity observed, from the daily diary maintained and feedback from industry supervisor.

Name of mentor:

Signature of mentor

Format-6:

End of training assessment by mentor along with Industry/Organization expert as external examiner (To be design by programme department)

Sr. No.	Roll No.	Name of Student	Division	Company / Organization Name	Name of Guide (Internal)	Industry/Organization expert (External)	Marks Obtained (50)

COURSE ID: ME

Course Name : Internship-II (3 weeks)
Course Code : CCG503
Course Abbreviation : GINT

1.TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	--	02
Practical	--	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Semester end		Total
	Theory	Practical	Theory Examination	Practical Examination (External)*	
Details of Evaluation	--	--	--	Practical Examination (External)	
Marks	---	--	---	50 E	50

* **Assessment as per scheme given in Table-3 and Table -4, E– External Examination**

2. RATIONALE

This Industrial training (internship) is compulsorily introduced for all the diploma programme to expose the students for a longer period to the industrial environment and develop the relevant good habits of industry culture among the students before they enter the industry. By exposing and interacting with the real-life industrial setting, the students will appreciate and get accustomed to the actual working of an industry along with the best practices adopted by them. The industrial culture skills fall under soft skills, life skills and hands-on which will be inculcated among the students. Such a short exposure will be an effective association with the industry, for the students and will be instrumental in orienting them to be industry ready, to a much greater extent than the present ones, after completion of the respective diploma programme.

3. COMPETENCY

The course is intended to develop the following competencies:

- Soft Skills such as: Communication, Presentation etc.
- Life skills such as: Time management, Safety, Innovation, Entrepreneurship, Team building etc.
- Hands-on skills such as: Design, Implementation, Different operations, Quality Assurance etc.

4. COURSE OUTCOMES

The industrial training (internship) related competencies as mentioned above to supplement those attained through several courses up to fourth semester of the relevant programme can be achieved by the following course outcomes:

CCG502-1: Communicate effectively (verbal and equally written) the works carried out.

CCG502-2: Prepare and present the report of the works carried out.

CCG502-3: Exercise time management and safety in the work environment.

CCG502-4: Work effectively as a team member.

CCG502-5: Demonstrate various quality assurance skills.

Note: Both ESE and PA part of assessment will be carried out by institute faculty and Industry training supervisor as explained in the relevant proforma of assessment.

5. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

a) **Training during the programme:** After 5th semester (During Winter Vacation).
b) **Duration of the training:** Three weeks
c) **Training Area:** Students should be trained in large and medium scale Industry / Organization. However, despite the best efforts by the institute, if large and medium scale Industry / Organization are not available to all students then, students can also be placed in small scale Industry / Organization.
d) These Industries / Organizations can be Government /Public limited/ or Private family enterprises.

For ***Civil engineering*** it can be public works department, irrigation department, public health engineering, municipal corporations, town and country planning, highway and roads authorities, railways, large and medium scale civil contractors, rural engineering departments, environment corporations, large and medium scale private construction companies, mining companies etc.

For ***Mechanical Engineering*** it can be manufacturing, fabrication, foundry or processing industry which may include compressors, boilers, engines, heat exchangers, air conditioning and refrigeration plants, conveyors etc are either manufactured or used. Power plants, Railways, process plants, ordinance factories, textile factories, automobile manufacturers or major automobile workshops.

For ***Electrical engineering*** it can be electricity transmission and distribution companies, power generating stations, sub stations, railways, industries manufacturing electrical products which may include industry where large motors/transformers etc. are used, process plants, electrical contractors.

For ***Electronic and Industrial Electronics engineering*** it can be telecommunication companies, post and telegraph department, manufacturer of telecommunication product, manufacturers of control equipments, manufacturer of CNC machines, any manufacturing industry where electronic controls are used either in production process or in its products, computer hardware manufacturers, signal divisions of railways, etc.

For ***IT i***ndustries it can be any software developers, cyber security companies, web page developers, networking companies, data base management companies, telecommunication companies or IT division of any other industries/finance/retail companies or organizations where software are used and maintained for various applications.

For **Metallurgical Engineering it** may include documenting the work, operating the lab mixtures, preparation of specimens, Metallographic testing of specimens, assisting the senior engineers etc.

6. ROLE OF PARENT DEPARTMENT OF THE INSTITUTES

Sr. No	Activity	Schedule
1	Collecting information about Industry / Organization available for training along with capacity (Format - 1)	Before completion of 4th semester
2	Student and mentor allocation as per the slots available for in-plant training (Desirable mentor-student ratio is 1:15)	Before commencement of 5th semester
3	Communication with Industry / Organization available for training along with capacity and its confirmation	Before first Unit Test of the 5th semester
4	Obtaining consent letter from parents / guardian (Format - 2)	Before second Unit Test of the 5th semester
5	Student enrollment for In-plant training (Format-3)	Before commencement of 5th semester examination
6	Issue letter to the Industry / Organization for the training along with details of students and mentors. (Format - 4)	During 5th semester examination
7	Mentors to carry out progressive assessment of the students during the in-plant training (Format - 5)	Each week of training
8	End of training assessment by mentor along with Industry / Organization expert as external examiner (Format - 6)	After 5th semester ESE

Suggestions:

a) Departments can take help of alumni or present students (if they or their parents or relatives have some contact in different industries) for securing placement.
b) The students would normally be placed as per their choices, in case of more demand for a particular Industry / Organization students would be allocated place based on their relative merit. However, if some students have arranged training placement in some companies with the help of their parents/relatives etc. then they will be given preference for placement in those companies.
c) Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry / Organization during the training before relieving students for training.

d) The faculty member during the visit to Industry / Organization will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.

7. EXPECTATIONS FROM INDUSTRY

Helping the institute in developing the following competencies among students

- Soft Skills such as: Communication, Presentation etc.
- Life skills such as: Time management, Safety, Innovation, Entrepreneurship, Team building etc.
- Hands-on skills such as: Design, Implementation, Different operations, Quality Assurance etc.

8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

a) Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.
b) Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.
c) He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.
d) Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and sent back the students.
e) It is the responsibility of the student to collect information from Industry / Organization about manufacturing processes / testing and quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/organizational structure etc.
f) During the training period students have to keep record of all the useful information
g) in Log book and maintain the weekly diary as provided and get it signed from mentor as well as Industry / Organization training in-charge.
h) In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.
i) Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

9. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organization. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 11. Organizational structure of Industry / Organization and General Lay Out
Chapter 12. Introduction of Industry / Organization (Type of products and services, history, turn over and number of employees etc.)
Chapter 13. Types of major equipment/instruments/ machines used in industry with their specification, approximate cost and specific use and their routine maintenance.
Chapter 14. Manufacturing Processes along with production planning and control methods.
Chapter 15. Testing of raw materials, components and finished products along with quality assurance procedures.
Chapter 16. Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 17. Safety procedures followed and safety gear used (includes Preventive maintenance schedule and breakdown maintenance procedures).
Chapter 18. Particulars of Practical Experiences in Industry / Organization if any in Production/ Assembly/ Testing/Maintenance.
Chapter 19. Short report/description of the project (if any done during the training)
Chapter 20. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

10. REFERENCES /BIBLIOGRAPHY

A) SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and testing manuals used in the industry. Students may also visit websites related to other industries wherein similar products are being manufactured as their learning resource.

B) TENTATIVE WEEK-WISE SCHEDULE OF INDUSTRIAL TRAINING

The industrial training is a common course to all programmes; therefore, the industry / Organization selection will depend upon the nature of programme and its related industry. The training activity may vary according to nature and size of Industry / Organization. The following table details suggestive schedule for industrial training for all programmes.

TABLE - 2 DETAIL WEEK SCHEDULE AND MARKS DISTRIBUTION

Sr. No.	Week No.	Details of activities to be completed during Industrial training	Marks distribution/ week for PA
1	Week No. 1	Induction to industry and its departments	05
		Study of layout and specifications of major machines, equipment and raw materials / components / software used.	05
		Study of setup, processes/ milestone project.	
		Study of QA/QC procedures.	05
		Study safety and maintenance procedure in an industry/organization	
2	Week No. 2	Finalize the project work in consultation with the industry personnel/department.	05
		Gather the resources/literature etc. necessary for the accomplishment of the project.	05
		Build the project as per requirements.	10
3	Week No. 3	Report submission and completion certificate	05
PA marks to be given by industry supervisor			25
PA marks to be given by polytechnic faculty based on performance			10
Total PA marks for training			**75**

Table - 3 ASSESSMENT SCHEME FOR INDUSTRIAL TRAINING

Training duration	PROGRESSIVE ASSESSMENT (*Weekly report of all 4week and attendance)*		END SEMESTER ASSESSMENT (*Seminar and Oral)*		Total marks	
Seven weeks	Max. marks	Min. marks	Max. marks	Min. marks	Max. marks	Min. marks
	#75	-----	75**	30	150	60

Assessed by Internal examiner

**assessed by external examiner based on report (25 Marks), presentation (25 Marks) and Viva-Voce (25 Marks)

TABLE - 4 DISTRIBUTION OF END-SEMESTER-EXAMINATION (ESE) MARKS OF INDUSTRIAL TRAINING

Marks for Industrial Training Report	Marks for Seminar/ Presentation	Marks for Oral/Viva-voce	Total ESE marls
25	25	25	75

FORMAT-1:

INFORMATION ABOUT INDUSTRY/ORGANISATION FOR TRAINING

1) Name of the industry/organization:
2) Address/communication details (incl email):
3) Contact person details:
4) Name:
5) Designation:
6) Email
7) Contact number/s:

8) Type:
    i. Govt / PSU / Pvt /
    ii. Large scale / Medium scale / Small scale …..
9) Products/services offered by industry:

10) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: Yes / No.
    a. b) If yes, whether you offer 6 weeks training: YES/NO
    b. c) Internship capacity possible:

Programme	Civil Engg	Mechanical Engg	Electrical Engg	……	Total
Male					
Female					
Total					

11) Whether accommodation available for interns Yes / No.
    a. If yes capacity:_____

12) Whether internship is charged or free:
    a. If charged please specify amount per candidate: _____

Signature of responsible person:

FORMAT-2:

OBTAINING CONSENT LETTER FROM PARENTS/GUARDIANS

(UNDERTAKING FROM PARENTS)

To,

The principal,

_____,

Subject: Consent for Industrial Training.

Sir/Madam,

I am fully aware that -

iii) My ward studying in _____ semester at your _____ institute has to undergo six weeks of Industrial training for partial fulfillment towards completion of Diploma in _____ Engineering.

iv) For this fulfillment he/she has been deputed at _____ industry, located at _____ for internship of ____ weeks for the period from _____ to _____.

With respect to above I give my full consent for my ward to travel to and from the mentioned industry. Further I undertake that –

e) My ward will undergo the training at his/her own cost and risk during training and/or stay.
f) My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
g) My ward is NOT entitled to any leave during training period.
h) My ward will submit regularly a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :

Name : _____

Address :_____

_____

Phone Number:_____

FORMAT-3:

STUDENT ENROLLMENT FOR IN-PLANT TRAINING (TO BE DESIGN BY PROGRAMME DEPARTMENT)

Sr. No.	Roll No.	Name of Student	Division	Company / Organisation Name	Address of Company / Organisation

FORMAT-4:

ISSUE LETTER TO THE INDUSTRY/ORGANIZATION FOR THE TRAINING ALONG WITH DETAILS OF STUDENTS AND MENTORS

To,
The HR Manager,
_____

Subject: Placement for Industrial training of ___ weeks in your organization….
Reference: Your consent letter no: ….

Sir,
With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.
Diploma programme in _____ Engg.

Sr. no.	Enrolment no.	Name:	Mentor

Diploma programme in _____ Engg.

Sr. no.	Enrolment no.	Name:	Mentor

Kindly do the needful and oblige.
Thanking you in anticipation

Yours sincerely,

(Principal)
Name of the Institute:
with Seal

FORMAT-5

PA OF INTERNSHIP-I

Academic year : 20 -20

Name of the industry:

Sr. No	Enrolment Number	Name of student	Marks				PA Marks by Industry Supervisor	PA based on Report by mentor faculty	Total
			Week 1 (Out of 15)	Week 2 (Out of 20)	Week 3 (out of 05)	Total (A) (out of 40)	Out of 25 (B)	Out Of 10 (C)	Out of 75 (A)+(B)+(C)

Marks for PA are to be awarded for each week considering the level of completeness of activity observed, from the daily diary maintained and feedback from industry supervisor.

Name of mentor:

Signature of mentor

FORMAT-6:

END OF TRAINING ASSESSMENT BY MENTOR ALONG WITH INDUSTRY/ORGANIZATION EXPERT AS EXTERNAL EXAMINER (TO BE DESIGN BY PROGRAMME DEPARTMENT)

Sr. No.	Roll No.	Name of Student	Division	Company / Organization Name	Name of Guide (Internal)	Industry/Organization expert (External)	Marks Obtained (50)

COURSE ID: ME

Course Name : INDUSTRIAL ORGANIZATION AND MANAGEMENT
Course Code : MEG501
Course Abbreviation: GIOM

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	03
Practical	--	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Theory Examination	
Details of Evaluation	Average of two tests of 20 marks each	-	Term End Online Theory Exam	Term End Online Theory Exam	
Marks	**20**	**-**	**80**	**-**	**100**

2. RATIONALE:

Management ability is a higher-grade ability, which every successful engineer must possess. This science has been developed in those days when it was treated as an art in earlier stages. It is impossible for an individual though technically sound to achieve goals of the organizations. Effective implementation of management policies is a tough task. The Diploma holder should learn these principles of management and various techniques.

3. COMPETENCY:

Plan and implement managerial and administrative strategies.

a) Cognitive : Use management principles and techniques.

b) Psychomotor: i) Apply management principles ii) Control inventory iii) Use personal protective devices for safety

c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality v) aesthetic presentation

4. COURSE OUTCOMES:

MEG501.1 Apply principles of management and carry out various functions of management.
MEG501.2 Prepare organization structure for small and medium scale industry.
MEG501.3 Perform duties of stores Incharge, material and finance manager.
MEG501.4 Practice industrial safety rules, codes, practices and acts.
MEG501.5 Apply various modern management techniques.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	**PO 2 Problem analysis**	**PO 3 design/ development of solutions**	**PO 4 Engineering Tools, experimentation and testing**	**PO 5 Engineering practice for society, sustainability and environment**	**PO 6 Project management**	**PO 7 Life-long learning**	**PSO 1 Workin Mfg. & Service sector**	**PSO 2 Start entrepreneurial activity**
Competency:	2	-	-	-	-	3	-	1	2
MEG501.1	2	-	-	-	-	3	-	1	2
MEG501.2	2	-	-	-	-	3	-	1	2
MEG501.3	2	-	-	-	-	3	-	1	2
MEG501.4	2	-	-	-	-	3	-	1	2
MEG501.5	2	-	-	-	-	3	-	1	2

6. CONTENT:

THEORY:

SECTION -I			
Sr. No	**Topics / Sub-topics**	**Lectures (Hours)**	**Theory Evaluation (Marks)**
MEG501.1 *Apply principles of management and carry out various functions of management.*			
1	**PRINCIPLES OF MANAGEMNET** 1.1 Concept of management 1.2 Principles of management 1.3 Objectives of management 1.4 Scope and importance of management 1.5 Levels of management 1.6 Managerial competencies: Communication, Planning and Administration, Team work, Strategic action and General awareness	**06**	**10**
2	**FUNCTIONS OF MANAGEMENT** 2.1 Planning: Forms of planning, Strategic levels and Planning, Phases of Planning 2.2 Decision Making: Decision making conditions, Basic types of Decisions 2.3 Organizing: Introduction to Organization design, basic types of Departmentalization, Co-ordination, Authority 2.4 Motivation: Work Motivation, Three approaches to Motivation, 2.5 Leadership: Leadership and Power, Leadership Development 2.6 Communication: The Communication process, Impact of Information Technology, Hurdles to effective communication 2.7 Controlling: Foundations of control, creative Effective control, Primary methods of control	**08**	**12**
3	**HUMAN RESOURSE MANAGEMENT (PERSONNEL MANAGEMENT)** 3.1 Definition and concept, 3.2 Aim, Objectives and functions of HR dept. 3.2 Principles of personnel policy, details recorded in policy 3.3 Recruitment and selection of employees 3.4 Training: Objectives, benefits, types and methods 3.5 Workers Participation in Management	**06**	**10**
MEG501.2 *Prepare organization structure for small and medium scale industry.*			

4	**FORMS OF BUSINESS ORGANISATION** 4.1 Types of industrial sectors 4.2 Forms of business organization 4.3 Individual Proprietorship 4.4 Partnership 4.5 Joint stock companies 4.6 Co-operatives 4.7 Public sectors 4.8 Government undertakings.	**04**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
MEG501.3 *Perform duties of stores Incharge, material and finance manager.*			
5	**MATERIALS MANAGEMENT** 5.1 Importance of purchase 5.2 Functions and Objectives 5.3 Duties of Material manager and Store Incharge 5.4 Methods of purchasing and procedure 5.5 Scope and importance of material management 5.6 Objectives of material management 5.7 Concept of EOQ 5.8 Concept of supply chain management 5.9 Modern trends in material management: MRP, ERP	**06**	**10**
6	**FINANCIAL MANAGEMENT** 6.1 Concept, Scope and Importance 6.2 Functions of financial management 6.3 Types of capital: Fixed, working 6.4 Factors affecting Working capital 6.5 Capitalization: over, under 6.6 Sources of Finance 6.7 Industrial taxation	**04**	**08**
MEG501.4 *Practice industrial safety rules, codes, practices and acts.*			
7	**INDUSTRIAL ACT & SAFETY** 7.1 Factory Act, Boiler Act, Workmen Compensation Act, ESI Act, pollution Control Act 7.2 Accidents: Economic aspects, direct and indirect cost of accidents Causes, Types, Remedies, Personal Protective Equipments (PPE), Reporting & Investigation of accidents	**08**	**12**

	7.3 Safety management: safety in industry, committees, programs, Safety codes, Safety training, 7.4 Occupational Safety and Health Administration – Promoting, norms and standards 7.5 Housekeeping: definition, concept, necessity, advantages, procedure		
MEG501.5 *Apply various modern management techniques.*			
8	**MODERN MANAGEMENT TECHNIQUES** 8.1 PERT & CPM 8.2 Various terms related with network analysis 8.3 Various Time estimates 8.4 Construction of Network Diagram 8.5 Computation of Critical Path	**06**	**10**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Knowledge	Comprehension	Application		
1	Principles of Management	02	04	04	***MEG501.1***	10
2	Functions of Management	02	04	06	***MEG501.2***	12
3	Human Recourse management	04	04	02	***MEG501.2***	10
4	Forms of Business organization	02	04	02	***MEG501.2***	08
5	Materials Management	04	02	04	***MEG501.3***	10
6	Financial Management	02	02	04	***MEG501.3***	08
7	Industrial Act & Safety	04	04	04	***MEG501.4***	12
8	Modern Management Techniques	02	02	06	***MEG501.5***	10
TOTAL		**22**	**26**	**32**		**80**

8. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Question Bank

9. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1	Banga and Sharma	Industrial Organisation& Management	Khanna Publisher
2	O. P. Khanna	Industrial Engg. & Management	Dhanpat Rai & sons New Delhi
3	P.C. Pandey & C.K. Sing	Management Science	Dhanpat Rai & sons New Delhi
4	P. T. Ghan	Industrial Oraganisation	Tata Mc Graw Hill
5	Waman S. Jawadekar	Management Information System	Tata Mc Graw Hill
6	P.C. Pandey &C.K. Sing	Management Science	Dhanpat Rai & sons New Delhi

b) Websites

i) nptel/iitm.ac.in
ii) http://iete.ac.in/subjects/amindustry/Mgmt.htm

* * *

COURSE ID: ME

Course Name : INDUSTRIAL ENGINEERING
Course Code : MEG503
Course Abbreviation : GIEG

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (Internal)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-IV	
Marks	**20**	As per Proforma-IV	**80**	**50 I**	**150**

I- Internal Assessment

2. RATIONALE:

Productivity is dependent on the productivity of the machines and the people in the manufacturing system. A Technician is required to work at the highest Productivity level. Hence, he should learn the techniques for improvement in productivity. A technician required to plan the production schedule accordingly organize material supply for the manufacturing activities. The total cost of goods produced contains large portion of overhead cost. Technician is required to minimize the stress in working. So he should be able to apply ergonomic principles in Engineering. Modern manufacturing systems employed in industry such as JIT, TPM, FMS, 5'S'and 'Kaizen' which should be known to the technician.

3. COMPETENCY

Improve productivity of organization through various teaching learning experiences.

a) Cognitive : Use productivity improvement techniques.

b) Psychomotor: i) Plant layout preparation ii) Design of material handling system iii) Standard time calculation

c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality v) aesthetic presentation

4. COURSE OUTCOMES:

MEG503.1 Evaluate different production systems and techniques of improving productivity.
MEG503.2 Select suitable Plant layout, material handling devices and plant facilities.
MEG503.3 Prepare process chart for analysis of existing process and improve the process.
MEG503.4 Design simple jigs and fixtures.
MEG503.5 Apply ergonomic principles in Engineering.
MEG503.6 Calculate standard time for a job.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Learner will be able to work in various sectors.	PSO2 Start entrepreneurial activity in the Mechanical Engineering field
Competency	3	3	2	2	1	1	-	3	1
MEG503.1	3	3	1	2	-	-	-	3	1
MEG503.2	3	3	3	3	1	1	-	3	1
MEG503.3	3	3	3	2	2	1	-	3	1
MEG503.4	3	3	3	3	1	1	-	3	1
MEG503.5	3	3	3	3	1	3	-	3	1
MEG503.6	3	3	3	3	1	3	-	3	1

6. CONTENT:

a) The following practical exercises shall be conducted as Laboratory Work in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Selecting a plant location for a desired product.	i) Select a site using various considerations	***MEG503.1***
2	Design a plant layout for above product on selected location on sheet.	i) Design of plant layout ii) Drawing of layout	***MEG503.2***
3	Design a material handling system suitable for above plant and show on sheet.	i) Design of material handling system	***MEG503.2***
4	Prepare process planning sheet of a selected product.	i) Preparation of process sheet ii) Make Sequence of operations iii)Line balancing	***MEG503.3***
5	Prepare record using suitable charts for selected product.	i) Preparation of process charts for recording	***MEG503.3***
6	Prepare scheduling using Gantt chart	i) Preparing Gantt chart	***MEG503.3***
7	Design Jig or fixture for production of above product.	i) Design of jig/fixture ii) Applying 3-2-1 principle of locating a job	***MEG503.4***
8	Apply ergonomic principles in the design of various systems in the above product.	i) Apply ergonomic principles in Engg. ii) Design with ergonomic considerations.	***MEG503.5***
9	Calculate standard time for manufacturing of above product	i) Calculate standard time Adding allowances	***MEG503.6***
10	Apply modern management technique for improving productivity of selected product	i) Applying modern management technique	***MEG503.6***

b) Micro-project: One Miniproject is required to be completed by each student individually which comprises of drawing a plant layout on drawing sheet with scale and showing all the details of one manufacturing /service industry. He should show in it the material handling equipments used for that product.

B. INDUSTRIAL EXPOSURE:

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above-mentioned laboratory/field-based experiences:

a. Follow safe practices
b. Practice good housekeeping
c. Practice energy conservation
d. Maintain tools and equipment
e. Follow ethical practices

C. THEORY:

SECTION -I

Sr. No	Topics	Lectures (Hours)	Theory evaluation Marks
MEG503.1 *Evaluate different production systems and techniques of improving productivity.*			
1.	**PRODUCTION SYSTEM** 1.1 Production - Definition, Types of production systems 1.2 Productivity - Importance, Measurement of Productivity, 1.3 Techniques of improving productivity 1.4 Elements of cost- Fixed cost, Variable Cost. 1.5 Break even analysis, Calculation of Breakeven point.	**04**	**06**
MEG503.2*Select suitable Plant layout, material handling devices and plant facilities.*			
2.	**PLANT LOCATION, PLANT LAYOUT AND MATERIAL HANDLING** 2.1 Plant Location - Importance of Site Selection, Factors Affecting Site Selection, Government Policies, Relaxation for Backward Areas. 2.2 Plant Layout - Objectives, types, design principles, Characteristics of Plant Layout, Symptoms of Bad Plant Layout. 2.3 Group technology, Cellular layout, 2.4 Material handling – Need, Principles and Types of material handling devices – conveyors, Hoist & cranes, forklift truck, trolleys, Pipes, Automated Guided Vehicles (AGV's) Selection of Material Handling systems and Devices.	**08**	**14**

*MEG503.3**Prepare process chart for analysis of existing process and improve the process.*			
3.	**PROCESS PLANNING** 3.1 Planning of Processes from raw material to finished product, Factors affecting Process Planning, 3.2 Deciding sequence of operations, Operation Sheet, Combined operations, Determination of Inspection Stages. 3.3 Selection of Machine 3.4 Techniques of assembly planning, Types of assembly. 3.4 Plant Capacity, Machine Capacity, Plant Efficiency. Numerical not to be asked	**08**	**10**
4.	**PRODUCTION PLANNING AND CONTROL** 4.1 Routing, Sequencing [n job 2 machines], 4.2 Scheduling, Dispatching, 4.3 Meaning of Control, Progressive Control, Gantt chart. 4.4 Concept of Line balancing	**04**	**10**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION II

Sr. No.	Topics / Sub - topics	Lectures (Hour)	Theory evaluation (Marks)
MEG503.4 *Design simple jigs and fixtures.*			
5.	**JIGS AND FIXTURES** 5.1 Introduction. Difference between jig and fixture Different components of Jig/ fixture 5.2 Types of locators and clamping devices, 3-2-1 principle of location. 5.3 General principles of jig/fixture design. 5.4 Types of jigs and fixtures. 5.5 Design of simple jigs and fixture.	**05**	**08**
MEG503.5 *Apply ergonomic principles in Engineering.*			
6.	**ERGONOMICS** 6.1 Concept, need, man-machine relationship, anthropometric and functional anatomy data, ergonomic in design of control members – push button, knobs, levers, cranks, hand wheel. 6.2 Ergonomic considerations applied to types and location of display. Compatibility in the design of control members.	**05**	**08**

MEG503.6 *Calculate standard time for a job.*			
7.	**WORK STUDY** 7.1 Method Study- Objectives, Procedure, Selection of work. 7.2 Recording Techniques - Outline process chart, Flow process chart, Two Hand process chart, Multiple activity chart, Flow diagram, String diagram, Travel chart. 7.3 Micro motion study-Critical Examination, Principles of Motion Economy. 7.4 Concept of ergonomics and workplace layout. 7.5 Work Measurement - Objectives, procedure 7.6 Time Study - Time Study Equipments, Allowances, Calculation of Standard Time, 7.7 Work Sampling, Analytical Estimating, Predetermined Motion Time Study (PMTS), 7.8 Concept of Merit Rating	**09**	**16**
8.	**MODERN TRENDS** 8.1 Just In Time manufacturing – Pull and push types of Manufacturing systems, 8.2 Waste reduction, 5'S', inventory reduction, single piece Production systems. Concept of continuous improvement (Kaizen) – DMIAC cycle, 8.3 Brain storming. Poka Yoke. 8.4 Concept of Flexible manufacturing system 8.5 Concept of Rapid Prototyping	**05**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Knowledge	Comprehension	Application		
1	Production System	02	02	02	*MEG503.1*	06
2	Plant location, Plant layout and Material Handling	04	04	06	*MEG503.2*	14
3	Process Planning	02	04	04	*MEG503.3*	10
4	Production Planning and Control	04	04	02	*MEG503.3*	10
5	Jigs and Fixtures	02	02	04	*MEG503.4*	08
6	Ergonomics	02	02	04	*MEG503.5*	08
7	Work Study	04	04	08	*MEG503.6*	16
8	Modern Trends	02	04	02	*MEG503.6*	08
TOTAL		22	26	32		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR CONTINUOUS ASSESSMENT AND PRACTICAL EXAMINATION

a) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

i) Continuous Assessment of Practical Assignments:

Domain	Particulars	Marks out of 25
Cognitive	Understanding	3
	Application	5
Psychomotor	Operating Skills	2
	Drawing / drafting skills	5
Affective	Discipline and punctuality	5
	Decency and presentation	5
TOTAL		**25**

The average of all the practical marks will be considered as marks out of 25 as per *Assessment Pro-forma IV.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted.

Final marks of term work shall be awarded as per *Assessment Pro-forma IV.*

b) Term-end Oral Examination (Internal):

Term-end Oral Examination (Internal) shall be conducted as per the following criteria:

Sr. no	Criteria	Marks allotted
1	Understanding of the subject	16
2	Quality and neatness of term work	16
3	Participation	10
4	Result table / calculations / graphs	08
	Total	**50**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Question Bank

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1	T R Banga, S C Sharma	Industrial Engineering & Management	Khanna Puplishers
2	O.P. Khanna	Industrial Engineering	Khanna Puplishers
3	I. L. O	Introduction to work Study	Tata McGraw Hill
4	Ray Siddhartha	Introduction to Materials Handling	NITTTR, Kolkata
5	Raymond A Kulwiec	Materials Handling Handbook	ASME and IMMS
6	Martin Heylander,	A Guide to the Ergonomics of Manufacturing:	East West Press, Taylor and Francis.
7	David J. Oborn	Ergonomics at Work	John Wiley and Sons, New York

b) Websites

i) www.faro.com/plant-layout/building-survey
ii) http://www.intergraph.com/learnmore/ppm/engineering-procurement-and-constru
iii) https://www.youtube.com/watch?v=I2Oz5cyr9qs (Line Balancing)
iv) https://www.ifm.eng.cam.ac.uk/research/dstools/quality-function-deployment

* * *

COURSE ID: ME

Course Name :FOUNDRY TECHNOLOGY
Course Code :MEG504
Course Abbreviation :GFTL

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. One PST of 25 marks ii. Microproject 25 Marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E-External Assessment

2. RATIONALE:

This subject will enable the students to understand principles behind designing a Gating system to produce a sound casting. This subject includes the considerations of designing a casting on the basis of systematic study of the various processes in the foundry.

3. COMPETENCY:

Produce a sound casting by applying principles of casting in the foundry.

a) Cognitive : Understand various functions in foundry.

b) Psychomotor: Operate various processes in Foundry and handle different situations in Foundry practice.

c) Affective : Develop attitude of i) Team work ii) safety consciousness.

4. COURSE OUTCOMES:

MEG504-1 Develop the skill of casting method.

MEG504-2 Apply the principle of casting design.

MEG504-3 Analyze casting defect.

MEG504-4 Identify the foundry mechanization and apply in the foundry industry.

MEG504-5 Recognize the principle and functions in foundry management.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic& Discipline specific knowledge	**PO 2 Problem analysis**	**PO 3 Design/ development of solutions**	**PO 4 Engineering Tools, Experimentation & Testing**	**PO 5 Engineering practice for society, sustainability & environment**	**PO 6 Project management**	**PO 7 Life-long learning**	**PSO1 Work in mfg & service sector**	**PSO 2 Start entrepreneurial ativity**
Competency	3	3	2	2	1	1	-	1	1
MEG504-1	3	3	1	2	-	-	-	1	1
MEG504-2	3	3	3	3	1	1	-	1	1
MEG504-3	3	3	3	2	2	1	-	1	1
MEG504-4	3	3	3	3	1	1	-	1	1
MEG504-5	3	3	3	3	1	3	-	1	1

6. CONTENT:

A. LABORATORY WORK

Lab work shall consist of the following:

a) The following practical exercises shall be conducted as Laboratory Work in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Design calculations for methoding data	Calculations for sprue, runner, ingrate	MEE504-1
2	Design calculations for methoding data	Calculations for sprue, runner, ingrate	MEE504-2
3	Design calculations for methoding data	Calculations for sprue, runner, ingrate	MEE504-2
4	Drawing a layout for a small / medium foundry	To understand the layout of the various foundries	MEE504-3
5	Guidelines for design of casting.	To understand the suitable designs for the casting	MEE504-3

b) Microproject:

Only one micro-project is planned to be undertaken by a group of four students. Micro-project is assigned to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs. A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

B) Industrial Exposure:

Visit to a mechanized foundry in local industrial area.

C. THEORY:

SECTION I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course OutcomeMEG504-1 *Develop the skill of casting method.*			
1	**GATING** 1.1 Elements of gating system, 1.2 Fundamentals of fluid flow, Bernoulli's Theorem, 1.3 Design of gating system, Types of gates, 1.4 Slag trap &filters with different cast metals and alloys. 1.5 Methoding of casting, pouring time calculation, Choke area calculation, Size calculation of pouring basin, 1.6 Sprue, Runner &Ingates, Slag trapping arrangements.	**06**	**12**
Course Outcome MEG507-1 *Develop the skill of casting method.*			
2.	**RISERING** 2.1 Design of feeding system (Risers), 2.2 Requirement and positioning of risers, 2.3 Range of feeding, 2.4 Feeding efficiency, 2.5 Riser design by Caine's method, 2.6 NRL method, Modulus method, Feeding distances.	**06**	**08**
Course OutcomeMEG504-2 *Apply the principle of casting design.*			
3	**SOLIDIFICATION OF CASTING** 3.1 Controlled solidification or directional solidification, Progressive solidification, 3.2 difference in quality of casting due to directional & progressive solidification, 3.3 Methods of achieving directional solidification, 3.4 Effect of gating system &risers in achieving directional solidification, 3.5 Use of chills, padding, exothermic material to achieve Directional solidification.	**08**	**12**
Course OutcomeMEG504-2 *Apply the principle of casting design.*			
4	**INTRODUCTION TO CASTING DESIGN** 4.1 Casting design aspects- design for economic moulding, 4.2 Design for overall manufacture, 4.3 Design problem related to sections/design of die casting- 4.4 Design fundamentals.	**04**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course OutcomeMEG504-3 *Analyze casting defect.*			
5	**CASTING DEFECTS ANALYSIS** 5.1 Parameters responsible for casting defects: Design of casting & pattern, pattern & core box equipment, moulding and core making equipment, gating and risering, moulding sand and core sand, melting and metallurgy, pouring, fettling and heat treatment. 5.2 Casting Defects: a) Gas defect- pin holes, blow holes, tears. b) Shrinkage defects- primary and secondary shrinkage, shrinkage, porosity. c) Metallurgical defects- hard spots, chilling, inverse chill, open grain, porosity. d) Defects related to sand practice and gating system –scab, cuts and washes, inclusion, swelling, rough surface, fusion, penetration. e) Mis run and cold shut. f) Mechanical defects-crush, drop, run out shift, flashes. g) Misc-Defects- short pours, leakage etc. 5.3 Analytical approach for trouble shooting- 5.4 Keen observations, importance of records and documentation, importance of process controls. 5.5 Salvaging castings, impregnation.	**12**	**24**
Course OutcomeMEG504-4 *Identify the foundry mechanization and apply in the foundry industry.*			
6	**FOUNDRY MECHANIZATION** 6.1 Mechanical equipments in foundry, 6.2 Sand handling & conveying, 6.3 Moulding machines, mechanical equipment for finishing, 6.4 Foundry layout for small, medium scale & large-scale foundries, 6.5 Safety and Accident prevention**.**	**06**	**08**
Course Outcome MEG504-5 *Recognize the principle and functions in foundry management.*			
7	F**OUNDRY MANAGEMENT** 7.1 Principles & Functions of Management, incentive schemes, 7.2 Quality consciousness through quality circle program, 7.3 Production planning & control, value analysis 7.4 Material Management: Integrated approach, Organizations and functions of purchase and store, Control of stores, Inventory control, Vendor Development-Terms of contract.	**06**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
I/1	Gating	08	02	02	MEF504-1	12
I/2	Risering	04	02	02	MEf504-1	08
I/3	Solidification of Casting	06	04	02	MEF504-2	12
I/4	Introduction to Casting Design	04	02	02	MEF504-2	08
II/5	Casting Defects Analysis	16	04	04	MEF504-3	24
II/6	Foundry Mechanization	02	02	04	MEF504-4	08
II/7	Foundry Management	02	02	04	MEF504-5	08
TOTAL		42	18	20		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. No	Criteria	Marks allotted
1	Attendance at regular practical	5
2	Preparedness for practical	5
3	Correct figures / diagrams	3
4	Observation tables	5
5	Result table / calculations / graphs	5
6	Safety / use of proper tools	2
	Total	25

The average of all the practical marks will be considered as marks out of 25 as per *Assessment Pro-forma III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted.

Final marks of term work shall be awarded as per *Assessment Pro-forma III.*

b) Term-end Oral Examination (External):

Term-end Practical Examination (External) shall be conducted as per the following criteria and marks to be added in *Proforma-III*:

Sr. no	Criteria	Marks allotted
1	Preparedness for practical	05
2	Use and selection of proper commands	05
3	Printing/plotting of drawings	05
4	Discipline and punctuality	05
5	Safety / use of proper tools	05
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations
iv) Item Bank

10. REFERENCE MATERIAL

A) Books

	Author	**Title**	**Publisher**
1.	P. C. Mukherji	Fundamentals of Metals and Casting	Oxford & IBH Pub. Co
2.	T RamanaRao	Metal casting principles and Practices	New Age International
3.	R. Wlodawer	Directional Solidification of Steel Casting	Elsevier
4.	P.N. Rao	Manufacturing Technology - Forming, Foundry and Welding	Tata McGraw-Hill Education
5.	Heine, Loper& Rosenthal	Principles of Metal Casting	Tata McGraw-Hill Education

B) Websites

a. http://www.nkn.in/efoundry.php
b. http://www.indianfoundry.org/
c. http://www.nifft.ernet.in/

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COURSE ID: ME

Course Name : REFRIGERATION AND AIR CONDITIONING
Course Code : MEG505
Course Abbreviation : GRAC

1. TEACHING AN EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	**Progressive Assessment**		**Term End Examination**		**Total**
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Assessment

2. RATIONALE:

This subject is classified as an Applied Technology. The 21st century predicts revolutionary developments in Refrigeration and Air Conditioning. Refrigeration and Air conditioning is one of the most meaningful job areas for diploma holders in Mechanical Engineering. Considering the wide and increasing use of Refrigeration and Air conditioning for domestic, commercial and industrial applications and the challenges put by the use of Refrigeration and air conditioning equipments in existing stage, it is absolutely necessary that Diploma Engineers should learn this subject. They should know the processes, equipments, systems of Refrigeration and Air Conditioning with their functioning, maintenance, repairs and measures to meet the challenges of the near future in this area. The basic Knowledge of Thermal Engineering is required for this subject.

3. COMPETENCY:

Identify and describe refrigeration and air conditioning systems and their practical applications

a) Cognitive : Understand construction and working principle of refrigeration and air Conditioning systems

b) Psychomotor: Conduct trial on different refrigeration and air conditioning systems to evaluate their performances

c) Affective : Attitude towards; i) Analyse and solve thermal load requirements ii) Safety in handling refrigerants iii) Environment and Sustainability iv) Interpret Charts

4.COURSE OUTCOMES:

MEG505.1 Understand basics of refrigeration and its various methods

MEG505.2 Describe types, working principles and construction of refrigeration and air-conditioning systems

MEG505.3 Enlist properties of refrigerants, their applications and effects on environment.

MEG505.4 Describe and select various components of vapour compression refrigeration system

MEG505.5 Apply values of different psychrometric properties using charts and tables for refrigeration and air-conditioning systems

MEG505.6 Estimate cooling and heating loads

5.COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

	PO 1 Basic and Discipline knowledge	PO 2 Problem Analysis	PO 3 Design / development of solutions	PO 4 Engineering Tools, experimentation and Testing	PO 5 Engineering Practices for Society, Sustainability and Environment	PO 6 Project management	PO 7 Lifelong learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial activity
Competency	2	3	3	2	2	2	1	3	3
MEG505-1	2	1	-	1	1	-	1	1	1
MEG505-2	2	1	-	1	1	-	1	1	1
MEG505-3	3	2	1	2	2	-	-	2	2
MEG505-4	2	2	1	2	2	1	-	2	2
MEG505-5	2	2	3	3	-	3	2	3	3
MEG505-6	3	3	3	2	-	2	-	3	3

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Trial on water cooler test rig.	Identify various components of refrigeration system and equipment, and calculate coefficient of performance.	**MEG505.2**
2	Trial on ice plant test rig.	Identify various components of refrigeration system and equipment, and calculate coefficient of performance.	**MEG505.2**
3	Visit to cold storage.	Observe working of Cold Storage.	**MEG505.2**
4	Demonstration of domestic refrigerator in View of construction, operation and controls used.	Identify various components of refrigeration system.	**MEG505.4**

5	Demonstration of various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC.	Handle various controls used for refrigeration and air conditioning plant safety.	**MEG505.4**
6	Identification of components of hermetically sealed compressor.	Identify various components of hermetically sealed compressor.	**MEG505.4**
7	Visit to repair and maintenance workshop in view of use of various tools and charging procedure.	Handle various tools used for refrigeration and air conditioning plant maintenance.	**MEG505.6**
8	Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).	Analyze cooling load based on application. Interpret psychometric chart to find various properties of air.	**MEG505.6**
9	Visit to central A.C. plant in view of ducting system, insulation system and Air distribution system (e.g. frozen food industry/ice- cream industry/mushroom plants/textile industries).	Observe working of central A.C. plant in view of ducting system, insulation system and Air distribution system.	**MEG505.6**
10	Trouble shooting of domestic refrigerator/window air- Conditioner.	Repair and Maintenance of domestic refrigerator/window air- Conditioner.	**MEG505.6**

b) MICRO-PROJECT:

Survey of Various Refrigerators/Ice Plants/Cold Storages/Central A C Plants/ Window and split Air conditioners, their capacities, ratings, manufacturers, comparisons, if possible, use and their specifications etc, available in market.

Form a Group of 4 students in a batch.

B) INDUSTRIAL EXPOSURE:

Included in experiment no. 3, 7 & 9.

C) THEORY:

Section I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course OutcomeMEG505.1 *Understand basics of refrigeration and its various methods*			
1	**BASICS OF REFRIGERATION** 1.1 History and Need of refrigeration. 1.2 Methods of refrigeration: Ice refrigeration, Refrigeration by expansion of air, Refrigeration by throttling of gas, Vapour refrigeration system, Steam jet refrigeration system, non-conventional methods of refrigeration like Vortex tube, Pulse tube refrigeration, solar refrigeration.	**04**	**10**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	1.3 Concept and comparison of heat engine, heat pump and Refrigerator. 1.4 Unit of refrigeration, C.O.P. and refrigerating effect. 1.5 Major application areas of R.A.C. like domestic, commercial and industrial.		
Course Outcome MEG505.2 *Describe types, working principles and construction of refrigeration and air-conditioning systems.*			
2.	**REFRIGERATION CYCLES** 2.1 Reversed Carnot Cycle and its representation on P-V and T-S diagram. 2.2 **Air Refrigeration Cycles:** Bell Coleman air refrigerator, it's representation on P-V and T-S diagram, Necessity of air craft cooling and types. (Simple numerical on Reversed Carnot cycle.) 2.3 **Vapour Compression Cycle (V.C.C):** Principle, components, Representation on P-H and T-S diagram, effects of wet compression, dry compression, calculation of COP, Effect of superheating, under cooling, suction pressure and discharge pressure, Actual V.C.C., (simple numerical), Methods of improving COP (no description). Introduction to multistage V.C.C., its necessity, advantages. 2.4 **Vapour Absorption system:** Principle, components and working of aqua- ammonia system (simple & practical), Li-Br Absorption System, Electrolux Refrigeration System, 2.5 Comparison of above Refrigeration Cycles.	**08**	**12**
Course Outcome MEG505.3 *Enlist properties of refrigerants, their applications and effects on environment*			
3	**REFRIGERANTS** 3.1 Classification of refrigerants. 3.2 Desirable properties of refrigerants. 3.3 Nomenclature of refrigerants. 3.4 Selection of refrigerant for specific applications. 3.5 Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants etc	**02**	**04**
Course OutcomeMEG505.4 *Describe and select various components of vapour compression refrigeration system*			
4	**EQUIPMENT SELECTION** 4.1 Components of Vapour Compression Refrigeration System 4.2 **Compressors:** Classification, Construction and working of open type, hermetic, centrifugal, rotary, screw and scroll compressor and their applications. 4.3 **Condensers:** Classification, description of air cooled and water cooled condensers, comparison and applications. Evaporative condensers.	**10**	**14**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	4.4 **Expansion devices:** Types, Capillary tube, automatic and thermostatic expansion valves and their applications. 4.5 **Evaporators and chillers:** Classification of evaporators construction and working of Bare tube, Plate surface, finned, shell and tube, flooded and dry expansion evaporator, Capacity of evaporator and their applications, Classification of chillers, Construction and working of dry expansion Chillers and flooded chillers and their applications. 4.6 High pressure and low-pressure cutouts 4.7 Selection criteria for Vapour compression refrigeration system components for the following applications: Water coolers, ice plants, cold storage, domestic refrigerator.		
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

Section II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course OutcomeMEG505.5 *Apply values of different psychrometric properties using charts and tables for refrigeration and air-conditioning systems*			
5	**PSYCHROMETRY** 5.1 Definition and necessity of air conditioning. 5.2 Properties of Air, Dalton's law of partial pressure. 5.3 Psychrometric chart. 5.4 Psychrometric processes, Bypass Factor, ADP, concept of SHF, RSHF, ERSHF, GSHF. 5.5 Adiabatic mixing of Air streams 5.6 Simple numerical using Psychometric chart 5.7 Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils.	**08**	**12**
Course Outcome *MEG505.6 Estimate cooling and heating loads*			
6	**COMFORT CONDITIONS AND COOLING LOAD CALCULATIONS** 6.1 Thermal exchange of body with environment 6.2 Factors affecting human comfort 6.3 Effective temp. and comfort chart 6.4 Components of cooling load- sensible heat gain and latent heat gain sources	**04**	**10**

Course Outcome *MEG505.2 Describe types, working principles and construction of refrigeration and air-conditioning systems.*			
7	**AIR- CONDITIONING SYSTEMS** 7.1 Classification of A.C. systems 7.2 Industrial and commercial A. C. systems 7.3 Summer, winter and year-round A. C. systems 7.4 Central and unitary A.C. systems 7.5 Application areas of A.C. systems	**06**	**10**
Course Outcome MEG505.2 *Describe types, working principles and construction of refrigeration and air-conditioning systems.*			
8	**AIR DISTRIBUTION SYSTEMS** 8.1 **Duct systems:** Closed perimeter system, extended plenum system, radial duct system, duct materials, requirement of duct materials, losses in ducts 8.2 **Fans and Blowers:** Types, working of fans and blowers 8.3 Air distribution outlets: Supply outlets, return outlets, grills, diffusers 8.4 **Insulation:** Purpose, properties of insulating material, types of insulating materials, methods of applying insulation.	**06**	**08**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Basics Of Refrigeration	04	02	04	MEG505.1	10
2	Refrigeration Cycles	06	04	02	MEG505.2	12
3	Refrigerants	02	02	00	MEG505.3	04
4	Equipment Selection	04	04	06	MEG505.4	14
5	Psychrometry	04	02	06	MEG505.5	12
6	Comfort Conditions and Cooling Load calculations	04	04	02	MEG505.6	10
7	Air- Conditioning Systems	04	04	02	MEG505.2	10
8	Air Distribution Systems	04	04	00	MEG505.2	08
TOTAL		32	26	22		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III.*

b) Term-end Oral Examination (External):

Term-end Oral Examination (External) shall be conducted by Internal, internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Sr. No.	Criteria	Marks allotted
1	Attendance at regular practical	3
2	Preparedness for oral	5
3	Correct figures / diagrams	5
4	Observation tables	5
5	Result table / calculations / graphs	5
6	Safety / use of proper tools	2
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio presentations

10. REFERENCE MATERIAL:

a) Books

Sr. No	Author	Title	Publisher
01	R. S. Khurmi	Refrigeration and Air Conditioning	S. Chand and Co
02	Arrora and Domkundwar	Refrigeration and Air Conditioning	Dhanpat Rai and Sons
03	Manohar Prasad	Refrigeration and Air Conditioning	New Age Publications
04	P. N. Ananthanarayanan	Refrigeration and Air Conditioning	Tata McGraw Hill
05	Roy Dossat	Principles of Refrigeration	Pearson Education
06	Edwin P. Anderson	Commercial Refrigeration	Taraporevala Sons & Co

b) Websites

i. http://www.alephzero.co.uk
ii. http://www.brighthubengineering.com
iii. http://en.wikipedia.org/wiki/Duct_(HVAC)

***

COURSE ID: ME

Course Name : AUTOMOBILE ENGNEERING
Course Code : MEG506
Course Abbreviation : GAEG

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Oral Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

E- External Examination

2. RATIONALE:

Automobile Engineering a technology subject helps to meet the need of automotive industry for specialized technicians. Due to liberalization of industrial policy in India, major global players in Automobile sector have launched their product in India. It is a key driver of countries economy. It has major employment potential for diploma holders. Automobile servicing in particular offers good job opportunities at village, town and city level. Thus, helps to generate self-employment in country.

3. COMPETENCY:

Identify and describe the functions of various automobile systems and their parts.

a) Cognitive : Understand constructional features and working principle of various automobile systems

b) Psychomotor : Inspect, identify and troubleshoot automobile problems

c) Affective : Develop attitude towards (i) Safety (ii)Punctuality in maintenance schedule

4. COURSE OUTCOMES:

MEG506.1 Classify automobile systems and describe automotive sub systems
MEG506.2 Explain the functions of transmission systems
MEG506.3 Understand functional requirements of control systems of automobile.
MEG506.4 Understand suspension system and chassis of automobile
MEG506.5 List various automobile electrical systems and show electrical and electronic circuit path arrangement

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life- long learning	PSO1 Learner will be able to work in various sectors.	PSO2 Start entrepreneurial activity in the Mechanical Engineering field
Competency:	2	3	3	2	3	-	3	3	2
MEE402-1	2	1	2	2	-	-	3	3	2
MEE402-2	3	1	1	3	1	-	3	3	3
MEE402-3	2	3	2	3	-	-	3	3	2
MEE402-4	3	3	2	3	1	-	3	3	1
MEE402-5	2	3	2	2	-		3	2	1

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

The following practical exercises shall be conducted as Continuous Assessment as detailed in the *Laboratory Manual* developed by the Institute in practical sessions of batches of about 22 students:

Sr. No	Laboratory experience	Skills developed	Course outcome
1.	Introduction & demonstration of use of various tools Instruments & equipments used in Automobile service station.	Able to select tools and equipments, understand proper handling of tools.	MEG506.1
2.	Carrying out preventive maintenance of four-wheeler/two-wheeler as per manufacturer's specifications.	Able to use service manual. adopt the recommended procedure for maintenance, testing etc.	MEG506.1
3.	Demonstration of single plate coil spring & diaphragm spring type clutch.	Able to observe various components of clutch, Construction of clutch. able to inspect & trouble shoot the problem in clutch.	MEG506.2
4.	Demonstration of synchromesh gear box.	Able to observe various components of synchromesh gear box. Inspect the gear box for probable troubles & find remedy on it.	MEG506.2
5.	Demonstration of differential gear box.	Able to observe various components of differential, understand function of each component, their constructional details.	MEG506.2
6.	Demonstration of rack & pinion steering box.	Able to understand function & working of steering box.	MEG506.3

7.	Demonstration of hydraulic brake system.	Able to understand function & working of brake system.	MEG506.3
8.	Visit to four-wheeler service station.	Understand sequence of service operations carried out in service station.	MEG506.4
9.	Mini project- Title-Advances in Automobile Engg. such as MPFI, TPFC, VTEC, Use of microprocessor. Automobile fuels such as ethanol, biodiesel, Battery, solar, etc.	Able to gain latest knowledge in this subject.	MEG506.1

b) MICRO-PROJECT:

Some Microprojects are given below:

i) Title-Advances in Automobile Engg. such as MPFI, , VTEC, Use of microprocessor.
ii) Automobile fuels such as ethanol, biodiesel, Battery, solar, etc.
Form a Group of 4 students in a batch.

B. INDUSTRIAL EXPOSURE:

i) As per practical no. 2 expert lectures by prominent personalities from industries.
ii) As per practical no. 8 an Industrial visit of students to service station.

7. THEORY:

SECTION-I

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG506.1 *Classify automobile systems and describe automotive sub systems*			
1.	**INTRODUCTION OF AUTOMOBILE** 1.1 Classification of automobiles 1.2 Vehicle layout & types 1.3 Body construction: Types & Nomenclature of car body 1.4 Introduction to aerodynamic body shapes 1.5 Safety feature in car Adaptive cruise control**,** Forward collision avoidance system, Autonomous braking, Adaptive headlights, Backup camera, Reverse backup sensors, Side view assist, Parking assist	**04**	**06**
Course Outcome MEG506.2 *Explain the functions of transmission systems*			
2	**AUTOMOBILE TRANSMISSION** 2.1 Clutch: Necessity, construction & working of coil spring & diaphragm spring type clutch. 2.2 Gear Box: Tractive effort and tractive resistance, Types of G.B construction & working of constant mesh G.B., &	**12**	**20**

	synchromesh G.B., Epicyclic G.B., Torque converter, Overdrive, Transfer case 2.3 Final drive: Necessity, construction & working of Propeller shaft & differential. 2.4 Axle-Type of rear axles, front axles & their applications		
***Course Outcome MEG*506.3** Understand functional requirements of control systems of automobile.			
3	**CONTROL SYSTEMS** 3.1Steering system- Requirement of steering system. Construction and working of steering linkage. Steering gear box- construction & working of rack and Pinion, recirculating ball type gearbox. Introduction to Power steering, 3.2 Steering geometry: Camber, caster, toe-in, toe-out, Kingpin inclination & their effects. 3.3 Brake system: Construction & working of hydraulic & Pneumatic brakes. Comparison of disc & drum brake.	**08**	**14**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	**Topics/Sub-topic**	**Teaching (Hours)**	**Theory Evaluation Marks**
Course OutcomeMEG506.4 *Understand suspension system and chassis of automobile*			
4	**SUSPENSION SYSTEMS,** 4.1Necessity & classification of suspension system. 4.2 Working & construction of Leaf spring, rigid axle suspension. 4.3 Introduction to air suspension 4.4 Construction & working of McPherson & wishbone, trailing link suspensions. 4.5 Construction & working of telescopic shock absorbers.	**08**	**12**
5	**WHEELS AND TYRES** 5.1 Construction & working of spoked wheel, disc wheel & light alloy cast wheel. 5.2 Types of rims, their construction & working. 5.3 Construction, working & comparison of radial, cross- ply and tube, tubeless tyre & tyre specifications 5.4 Factors affecting tyre life 5.5 Wheel Alignment and Balancing	**08**	**12**

Course OutcomeMEG506.5 *List various automobile electrical systems and show electrical and electronic circuit path arrangement*			
6	**AUTOMOBILE ELECTRICAL SYSTEMS** 6.1 Battery: Working, Construction & Rating of battery. 6.2 Ignition system: Construction & Working of electronic and CDI ignition system. 6.3 Starting system: Construction & Working of starting motor. 6.4 Charging system: Construction & Working of alternator 6.5 Wiring system: Harnessing & colors codes. 6.6 Lighting system: Head light, Tail light, Indicator light & their circuits. 6.7 Gauges: Construction & Working of Fuel level gauge, oil gauge and water temperature gauge. 6.8 Use of microprocessor in automobile control systems	**08**	**16**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

8. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Course outcome	Total marks
		Knowledge	Comprehension	Application		
I/1	Introduction of Automobile	04	02	-	MEG506.1	06
I/2	Automobile Transmission system.	04	08	08	MEG506.2	20
I/3	Control System.	02	06	06	MEG506.3	14
II/4	Suspension System	04	04	04	MEG506.4	12
II/5	Wheels and Tyres.	04	04	04	MEG506.4	12
II/6	Automobile Electrical System	04	06	06	MEG506.5	16
				Total		80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted. Marks to be added in *Proforma-III.*

b) Term-end Practical/ Oral Examination (Internal /External):

Term-end Practical/Oral Examination (Internal /External) shall be conducted by Internal, internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of term work	05
2	Participation	05
3	Understanding	05
4	Representation	05
5	Safety / use of proper tools	05
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures and discussions
ii) Classroom practices
iii) Laboratory experiences and laboratory interactive sessions
iv) Experiences and discussions through industrial visits
v) Time bound assignments

Teaching and Learning resources:

i) Chalk board
ii) Demonstrative kits
iii) Demonstrative charts
iv) LCD presentations
v) Audio presentations
vi) Question Bank

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Title	Author name
1.	Automobile engg. vol I & II	Kirpal singh
2.	Automobile engg.	GBS Narang.
3.	Automotive technology	H.M. Sethi.
4.	Automotive mechanics.	Crouse, Anglin.
5.	The Motor Vehicle	Newton Garrett.
6.	Automobile Engg.	K.K.Jain & R.B. Asthana.

b) Websites:

i) http://chemwiki.ucdavis.edu
ii) http://en.wikipedia.org

***

COURSE ID: ME

Course Name : INDUSTRIAL HYDRAULICS AND PNEUMATICS
Course Code : MEG507
Course Abbreviation : GIHP

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (External))	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**125**

E-External Assessment

2. RATIONALE:

Hydraulic and pneumatic operated machines and equipment are widely used in various industries due to its versatility and adaptability to automation. Mechanical engineers are required to use and maintain such systems in different segments of industries. This competency needs the knowledge of construction and working of different components of hydraulic and pneumatic systems. This course will give the students basic skills and knowledge to use different hydraulic and pneumatic systems

3. COMPETENCY:

Use different types of hydraulic and pneumatic systems for engineering application.

a) Cognitive :-Identify various components of hydraulic and pneumatic systems.

b) Psychomotor: Make connections as per circuit diagram and operate Hydraulic and Pneumatics system

c) Affective : Attitude of i) Analytical Thinking ii) Safety iii) Selection

4. COURSE OUTCOMES:

MEG507.1- Recognize standard schematic symbols for hydraulic& Pneumatics system

MEG507.2- Identify various components of hydraulic and pneumatic systems

MEG507.3- Describe Operation and applications of hydraulic & Pneumatics components and accessories

MEG507.4- Operate valves and actuators used in hydraulics and pneumatics

MEG507.5- Prepare hydraulic or pneumatic circuit for simple industrial problem

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and COs	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Work in mfg& service sector	PSO2 Start entrepreneurial activity in the Mechanical Engineering field
Competency	-	3	3	3	3	-	2	3	1
MEG315-1	3	3	3	1	3	-	2	3	1
MEG315-2	-	3	3	1	3	-	1	3	2
MEG315-3	-	3	3	1	3	-	1	3	1
MEG315-4	-	3	3	1	3	-	2	3	1
MEG315-5	-	3	3	1	3	-	2	3	1

6. CONTINUOUS ASSESSMENT (CA)

Practical Exercises and related skills / competencies to be developed:

a) The following practical exercises shall be conducted as Continuous Assessment in Laboratory in practical sessions of batches about 22 students

Sr. No.	Laboratory experience	Skills / Competencies to be developed	Course Outcome
1	ISO symbols for Hydraulic System elements.	Identification of symbols of various Hydraulic System elements.	MEG507-1
2	Study of various Hydraulic System elements.	Know working of Hydraulic System elements.	MEG507-2, MEG507-3
3	Meter In and Meter Out circuit (hydraulic)	Make connections as per circuit diagram and actuate	MEG507-4, MEG507-5
4	Bleed Off Circuit. (hydraulic)	Make connections as per circuit diagram and actuate	MEG507-4, MEG507-5
5	Sequencing Circuit (hydraulic)	Make connections as per circuit diagram and actuate	MEG507-4, MEG507-5
6	ISO symbols for Pneumatic System elements.	Identification of various Pneumatic System elements.	MEG507-1
7	Study of various Pneumatic System elements.	Know working of Pneumatic System elements.	MEG507-3
8	Speed control circuits. (pneumatics)	Make connections as per circuit diagram and actuate	MEG507-4, MEG507-5
9	Sequencing Circuits. (pneumatics)	Make connections as per circuit diagram and actuate	MEG507-4, MEG507-5
10	Care and Maintenance of Hydraulic and Pneumatic System elements	Servicing of various Hydraulic and Pneumatic System elements.	MEG507-3

b) **MICRO PROJECT:**

The micro project may be industrial application based, internet based, work shop based, laboratory based or field based. The micro project may encompass one or more CO of the course. Maximum no of students in the micro project group should be four.

Suggested topics for micro projects

i) Market survey of oils used in hydraulic systems (manufacturers, specifications, trade names, price etc. (field based/ internet based)
ii) Market survey of pumps used in hydraulic systems (manufacturers, specifications, trade names, price etc. (field based/ internet based)
iii) Market survey compressors used in pneumatic systems (manufacturers, specifications, trade names, price etc. (field based/ internet based)
iv) Market survey of valves, actuators, pipes, seals and accessories used in hydraulic and pneumatic systems. (Field based/ internet based)
v) Visit report of service station, industry using hydraulic/ pneumatic systems. (Field based)
vi) Visit report of earth moving machinery repairing workshop. (Field based)
vii) Prepare charts of hydraulic pneumatic symbols. (Laboratory based)
viii) Prepare cut section model of any hydraulic pneumatic component (work shop based)

B. INDUSTRIAL EXPOSURE:

SN	Mode of Exposure	Topic
1.	Industrial visit to study automation by means of hydraulic and pneumatic system such as LPG bottling plant, Hydraulic press, Injection Moulding machine	Industrial situations

C. THEORY:

SECTION-I

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEG507-1 *Recognize standard schematic symbols for hydraulic& Pneumatics system* **MEG507.2-***Identify various components of hydraulic and pneumatic systems*			
1.	**INTRODUCTION TO OIL HYDRAULIC SYSTEMS** 1.1 General layout of oil hydraulic system 1.2 ISO Symbols used of hydraulic system 1.3 Practical applications of hydraulic systems 1.4 Merits and limitations of oil hydraulic systems 1.5 Oils for hydraulic systems, their properties. ISO and SAE grades of oil. 1.6 Selection of fluids, effect of temperature and pressure on hydraulic Fluid 1.7 Hazard and safety in Industrial hydraulic systems	**04**	**06**

Sr. No	Topics / Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course OutcomeMEG507-3: *Operation of hydraulic& Pneumatics components and accessories*			
2.	**PUMPS FOR HYDRAULIC SYSTEMS** 2.1 Pumps: Vane pump, gear pump, Gerotor pump, screw pump, piston pump (Classification, construction, working principle, symbols) 2.2 Selection of pump for power transmission, pump performance.	**04**	**06**
Course Outcome MEG507-3*Describe operation and applications of hydraulic& Pneumatics components and accessories* ***MEG507.4-*** *Operate valves and actuators used in hydraulics and pneumatics*			
3.	**COMPONENTS OF HYDRAULIC SYSTEM** **A] VALVES** 3.1 Pressure control valves: Pressure relief valve, Pressure reducing valve, Pressure unloading valve, counter balance valve. 3.2 Direction control valves: Poppet valve, spool valve, one-way valves. 3/2, 4/2, 5/3 D.C. valves with pilot, manually & solenoid operated, Sequence valves. 3.3 Flow control valves: Pressure compensated, non-pressure compensated flow control valve. (Classification, construction, working principle and symbols of all components) **B] ACTUATORS** 3.4 Actuator: Construction, working and symbols 3.5 Rotary Actuators: Hydraulic motors 3.6 Linear Actuators: Cylinders- Single acting, Double acting **C] ACCESSORIES** 3.7 Accessories: Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Accumulators. (Types, construction, working principle and symbols of all components)	**12**	**20**
Course OutcomeMEG507-5*Prepare circuit diagram for simple industrial problem*			
4.	**HYDRAULIC CIRCUITS** 4.1 Meter in, Meter out circuits, 4.2 Bleed off circuit 4.3 Sequencing circuit, (time dependant and travel dependant) 4.4 Hydraulic circuits for Milling machine, grinding machine, Shaper machine 4.5 Motion synchronization circuits.	**04**	**08**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION-II

Sr. No	Topics/Sub-topic	Teaching (Hours)	Theory Evaluation Marks
Course Outcome MEG507-1 *Recognize standard schematic symbols for hydraulic& Pneumatics system –* ***MEG507.2-****Identify various components of hydraulic and pneumatic systems*			
5	**INTRODUCTION TO PNEUMATIC SYSTEMS** 5.1 General layout of pneumatic system 5.2 Applications of pneumatic system 5.3 Symbols used in pneumatic system 5.4 Merits and limitations of pneumatic systems	**04**	**06**
Course Outcome MEG507-3 Operation of hydraulic& Pneumatics components and accessories			
6	**COMPONENTS OF PNEUMATIC SYSTEM** **A] COMPRESSOR AND CONTROL VALVES** 6.1 Reciprocating & Rotary compressors 6.2 Control Valves: Pressure regulating valves, Flow Control Valves, Direction Control, Dual pressure valve, Shuttle valve, Quick exhaust valve, Time delay valve. **B] ACTUATORS CLASSIFICATION** 6.3 Linear: Cylinders- Types, construction & working principle 6.4 Rotary: Air motors, construction, working principle **C] ACCESSORIES** 6.5 Accessories: Pipes, Hoses, Fittings, FRL unit (Types, construction, working principle and symbols of all components)	**15**	**24**
Course OutcomeMEG507.5- *Prepare circuit diagram for simple industrial problem*			
7	**INDUSTRIAL PNEUMATIC CIRCUITS** 7.1 Speed control circuits, Sequencing circuits, AND, OR circuits, Time & travel dependent controls- Principle, Construction and practical applications,	**05**	**10**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Applica--tion		
1	Introduction to oil hydraulic system.	2	2	2	MEG507-1 MEG507-2	6
2	Pumps for hydraulic system.	2	2	2	MEG507-3	6
3	Components of Hydraulic System	6	6	8	MEG507-3 MEG507-4	20
4	Hydraulic circuit	2	2	4	MEG507-5	8
5	Introduction to pneumatic system	2	2	2	MEG507-3	6
6	Components of pneumatic system.	8	8	8	MEG507-3	24
7	Pneumatic circuit	2	4	4	MEG507-5	10
	Total	24	26	30		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK AND PRACTICAL EXAMINATION

a) Criteria for Continuous Assessment of Practical work and Progressive Skill Test:

i) Continuous Assessment of Practical:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term ***Progressive Skill*** *Test* of **25** marks shall be conducted as per criteria given in *Proforma-III*:

b) Term-end Practical Examination (External):

Term-end Practical Examination (External) shall be conducted by internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of term work	05
2	Participation	05
3	Understanding	05
4	Representation	05
5	Safety / use of proper tools	05
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures cum Demonstrations
ii) Classroom practices

Teaching and Learning resources:

i) Chalk board
ii) LCD presentations
iii) Audio video presentations
iv) Internet
v) Question Bank

10. REFERENCE MATERIAL

a) Books:

Sr. No.	Author	Title	Publisher
1.	S. R. Majumadar	Oil Hydraulic Systems	Tata McGraw Hill
2.	S. R. Majumadar	Pneumatic Systems	Tata McGraw Hill
3.	J. J. Pippenger	Industrial Hydraulics	Tata McGraw Hill
4.	ANDREW PARR	Hydraulics & Pneumatics	JAICO

b) Websites:

1. https://nptel.ac.in/content/storage2/courses/112106175/Module%201/Lecture%201.pdf
2. https://www.hydraulicspneumatics.com/fluid-power-basics/article/21884136/engineering-_essentials-fundamentals-of-hydraulic-pumps

***

COURSE ID: ME

Course Name : TOOL ENGINEERING
Course Code : MEG 508
Course Abbreviation : GTLG

1. TEACHING AND EVALUATION SCHEME:

Pre-requisite Course(s) : <*nil* >

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory	Practical Examination (External)	
Details of Evaluation	Average of two tests of 20 marks each	i) 25 marks for each practical ii) One PST of 25 marks	Term End Theory Exam (03 hours)	As per Proforma-III	
Marks	**20**	As per Proforma - III	**80**	**50 E**	**150**

E- External Examination

2. RATIONALE:

This subject is classified as technology subject. It is intended to impart concepts, principles and procedures of tool engineering to the students so that they can understand the procedure of tool design to achieve highest productivity and perform duties as a technician in tool room, shop floor, quality control. The student can work as supervisor in plastic molding shop and as a sales engineer in tool industry.

3. COMPETENCY:

Use various tools for different machining operations

a) Cognitive : Understand various types of tools their geometry.
b) Psychomotor: Design and forming of various tools and dies.
c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality

4. COURSE OUTCOMES:

1) **MEG508.1-** Select cutting tools and its material using data book and manufacturer's catalogue.
2) **MEG508.2-** Estimate tool wear and tool life.
3) **MEG508.3-** Describe press tools and dies.
4) **MEG508.4-** Design strip layout for given component.
5) **MEG508.5–** Select cutting fluid for machining process.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels :1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation**]**

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic and discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design /development of solutions	PO 4 Engineering Tools, Experimentation and Testing	PO 5 Engineering practices for society, sustainability and environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1 Work in mfg& service sector	PSO 2 Start entrepreneurial activity
Competency:	1	-	-	3	-	-	-	2	-
MEG508-1	1	-	-	3	-	-	-	2	-
MEG508-2	1	-	-	3	-	-	-	2	-
MEG508-3	1	-	-	3	-	-	-	2	-
MEG508-4	1	-	-	3	-	-	-	2	-
MEG508-5	1	-	-	3	-	-	-	2	-

6. CONTENT:

A) Continuous Assessment (CA):

a) Practical Exercises and related skills to be developed:

Sr No.	Title of Practical Exercise	Skills / Competencies to be developed	Course Outcome
1	Report on Visit to press shop for study of presses.	Understand working and construction of different press and can differentiate between types of press.	**MEG508-3**
2	Sketches of Combination Die, Progressive Die, and Compound die, Inverted Die, Drawing Die, and Bending Die.	Understand different types of dies, their constructional features and working principal.	**MEG508-1**
3	Drawing of strip layout of simple component (Different component for every student), and calculation of material utilization factor.	Understand and able to select suitable layout for a given work piece and calculation of material utilization factor.	**MEG508-4**
4	Sketches of Injection, Moulding die, Pressure diecasting die, forging die.	Understand working principal and construction of different types of injection molding dies.	**MEG508-3**
5	Two problems on calculation of Cutting forces and shear angle based on Merchant's circle.	Understand calculation of cutting forces and shear angle based on Merchant's angle. Understand tool angle of various cutting tools and their impotence.	**MEG508-2**
6	One assignment each on development of blank length for bending operation and single stroke drawing operation.	Understand and able to calculate blank length and blank diameter of a given work piece. Design and	**MEG508-3**

		draw drawing die for a given component.	
7	One problem on Selection and designation of carbide tools based on different machining processes.	Understand selection and designation of different carbide tools.	**MEG508-1**
8	Sketches of different types of cutting tools showing details of tool angles.	Understand tool angles of various cutting tools and their importance.	**MEG508-1**
9	One assignment on types of Punches and pilots, strippers	Able to select suitable punch, pilot and stripper for a given Application	**MEG508-3**

b) Micro-project:

Students should conduct following activity in group of 4-6students and prepare reports of about 5- 10 pages, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews. Evaluation shall be of 25 marks and marks should be added in Proforma – III.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each mini-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The student taught to submit mini-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro projects is given here. Similar micro-projects could be added by the concerned faculty:

i) Preparation of Wax/Rubber model of various dies/single point cutting tools.
ii) Collect various Carbide inserts as per ISO specification
iii) Measure press capacity of any press available in industry or nearby industry.
iv) Sketch different jigs/fixtures/clamping devices available in institute workshop.
v) Identify and restrict degree of freedom of a given component for designing a clamping/locating device for a given machining operation.

B) INDUSTRIAL EXPOSURE:

Sr. No.	**Mode of Exposure**	**Topic**
1.	Industrial visit	Press Tools
2.	Industrial Visit	Die design fundamentals, Forming dies

C) THEORY:

SECTION I

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome: MEG508-1 Select cutting tools and its material using data book and manufacturer's catalogue. ***MEG508.5 –***Select cutting fluid for machining process.			
1	**METAL CUTTING** 1.1 Mechanics of Metal cutting: requirements of tools, cutting forces 1.2 Types of chips, chip thickness ratio, shear angle (Simple Numericals) 1.3 Types of metal cutting process: Orthogonal, oblique and form cutting. 1.4 Cutting fluids: Types, characteristics and applications.	**10**	**16**
2	**CUTTING TOOL GEOMETRY** 2.1 Single point cutting tool, drills, reamers, milling cutters.	**02**	**06**
3	**TOOL MATERIALS** 3.1 Types, characteristics, applications. 3.2 Heat treatment of tool steels, 3.3 Specification of carbide tips, Types of ceramic coatings.	**06**	**10**
Course Outcome **MEG508.2-** Estimate tool wear and tool life.			
4	**TOOL WEAR** 4.1 Tool wear, Types of wear, 4.2 Tool life, Tool life equations. 4.3 Machinability: definition, factors affecting machinability, machinability index.	**06**	**08**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION II

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
Course Outcome **MEG508.3-** Describe press tools and dies.			
5	**PRESS TOOLS** 5.1 Presses: Introduction, Types, Specification.	**02**	**04**
6	**TYPES OF DIES AND CONSTRUCTION** 6.1 Simple Die, Compound Die, Progressive Die, Combination die. 6.2 Punch & die mountings, pilots, strippers, miss feed	**04**	**08**

Sr. No	Topics / Sub-topics	Lectures (Hours)	Theory Evaluation (Marks)
	detectors, Pressure Pads, Knock outs, stock guide, Feed-Stop, guide bush, guide pins.		
Course Outcome **MEG508.4 -** Design strip layout for given component.			
7	**DIE DESIGN FUNDAMENTALS** 7.1 Die Operations: blanking, piercing, shearing, cropping, notching, lancing, coining, embossing, stamping, curling, drawing, bending, forming. 7.2 Die set, Die shoe, Die area 7.3 Calculation of clearances on die and punch for blanking And piercing dies, Strip layout 7.4 Calculation of material utilization factor.	**06**	**10**
8	**FORMING DIES** 8.1 Bending: methods, Bending Dies, bend allowance, spring back, spanking, bending pressure, pressure pads, and development of blank length. 8.2 Drawing: operations, Metal flow during drawing. 8.3 Calculation of Drawing blank size, variables affecting metal flow during drawing, 8.4 Single action and double action dies, combination dies.	**08**	**12**
9	**FUNDAMENTALS OF OTHER TOOLS** 9.1 Constructional features of: Pressure Die casting dies, metal extrusion dies, injection Moulding dies, forging dies, plastic extrusion dies.	**04**	**06**
	TOTAL	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Topic No.	Name of topic	Distribution of marks (Cognitive level-wise)			Course Outcome	Total Marks
		Remember	Understand	Application		
1	Metal Cutting	04	04	08	MEG508 – 1	16
2	Tool Wear	03	03	-	MEG508- 1-3	06
3	Tool Material	03	03	04	MEG508 - 1-3	10
4	Cutting Tool geometry	02	02	04	MEG508 - 1-3	08
5	Press Tools	02	02	-	MEG508 - 1-3	04
6	Type of dies and Construction	02	03	03	MEG508- 1-3	08

7	Die design fundamentals	04	04	02	MEG508 - 4	10
8	Forming dies	04	04	04	MEG508-1-3	12
9	Fundamentals of other tools	02	02	02	MEG508-3	06
TOTAL		**26**	**27**	**27**		**80**

Semester end exam question paper should be such that total marks of questions on each topic is one and half times
the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR PRACTICAL ASSIGNMENTS AND PRACTICAL EXAMINATION

c) Assessment Criteria for Practical Assignments:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks. It includes criteria such as Cognitive, Psychomotor and Affective domains. Average marks to be added in *Proforma-III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted as per criteria. Marks to be added in *Proforma-III.*

Final marks of term work shall be awarded as per *Assessment Pro-forma III.*

b) Term-end Practical Examination (External):

Term-end Practical Examination (External) shall be conducted by internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of term work	05
2	Participation	05
3	Understanding	05
4	Representation	05
5	Safety / use of proper tools	05
	Total	**25**

9. INSTRUCTIONAL STRATEGIES:

Instructional Methods:

i) Lectures
ii) Demonstration during practicals

Teaching and Learning Resources:

i) Chalk board
ii) LCD Projector

10. REFERENCE MATERIAL:

a) Books / Journals / IS Codes

Sr. No.	Author	Title	Publisher
1.	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology – Volume I & II	Media Promoters and Publishers limited
2.	B.S. Raghuvanshi	Elements of workshop Technology – Volume I & II	Dhanpat rai & Sons
3.	R. K. Jain	Production Technology	Khanna Publication New Delhi
4.	Production Technology	Hindustan Machine Tools (HMT)	Tata Publication

b) Websites

1) http://nptel.ac.in
2) www.egr.msu.edu/~pkwon/me478
3) www.basicmechanicalengineering.com/lathe~machine~operation~basic:turning.operations
4) www.planomillers.com/drilling.machine.html
5) www.jsw.co.in/en/products/injectionmoulding
6) http://www.opm.gov/fedclass/fws3869.pdf

* * *

Course ID: ME

Course Name : WELDING TECHNOLOGY
Course Code : MEG509
Course Abbreviation : GWLT

1. TEACHING AND EVALUATION SCHEME:

Pre- requisite Courses (s) : Nil

Teaching Scheme:

Scheme component	Hours / week	Credits
Theory	03	05
Practical	02	

Evaluation Scheme:

Mode of Evaluation	Progressive Assessment		Term End Examination		Total
	Theory	Practical	Theory Examination	Practical Examination (External))	
Details of Evaluation	Average of two tests of 20 marks each	i. 25 marks for each practical ii. One PST of 25 marks	Term End Theory Exam (03 hours)	Term end Practical Examination	
Marks	**20**	As per Proforma-III	**80**	**50 E**	**150**

2. RATIONALE:

As the standard of living continues to improve in most fabrication revolution using both common and more exotic processes, has been created. The exotic type of metal fabrication especially requires use of the most modern welding equipments and techniques.

3. COMPETENCY:

Perform welding operations in Fabrication Work

a) Cognitive : Apply various types of welding Processes.

b) Psychomotor: Use Welding processes for fabrication

c) Affective : Attitude of i) precision ii) accuracy iii) safety iv) punctuality

4. COURSE OUTCOMES:

MEG509.1- Distinguish different welding processes.

MEG509.2- Select proper welding process for given job

MEG509.3- Demonstrate various types of welding processes

MEG509.4- Interpret welding drawing

MEG509.5– Follow safe practices in welding operations.

5. COMPETENCY, COURSE OUTCOMES AND PROGRAMME OUTCOMES (CP-CO-PO) MATRIX:

[Note: Correlation levels: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), "-": no correlation]

Competency and Cos	Programme Outcomes POs and PSOs								
	PO 1 Basic& Discipline specific knowledge	PO 2 Problem analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practice for society, sustainability & environment	PO 6 Project management	PO 7 Life-long learning	PSO1 Work in mfg & service sector	PSO 2 Start entrepreneurial ativity
Competency	3	3	2	2	1	1	-	1	1
MEG509-1	3	3	1	2	-	-	-	1	1
MEG509-2	3	3	3	3	1	1	-	1	1
MEG509-3	3	3	3	2	2	1	-	1	1
MEG509-4	3	3	3	3	1	1	-	1	1
MEG509-5	3	3	3	3	1	3	-	1	1

6. CONTENT

Continuous Assessment (CA):

a) The following practical exercises shall be conducted as Laboratory Work in practical sessions of batches of about 22 students:

Sr. No	Laboratory experience	Skills developed	Course outcome
1	Demonstration of Shield arc welding.	The ability to know the process and equipment. The problems, limitations and applications of the process.	MEF509.1 MEF509.2 MEF509.3
2	Demonstration of Submerged Arc Welding.		
3	One job on Carbon Arc Welding.		
4	Demonstration of Gas Shield arc welding.		
5	One job on Gas welding.		
6	One job on Gas Cutting (Different profile cutting)		
7	Study of other welding processes.		
8	Welding Symbols.	To know the welding drawings.	MEF509.4
	Study of Care and Safety in welding operation.	Safety of the operator is improved.	MEF509.5
10	Industrial visit to fabrication workshop for Arc welding and Gas welding Gas welding.	To understand the practical difficulties in the operation.	
11	Industrial visit for other welding processes.		

b) Miniproject:

One Miniproject is required to be completed by each student individually which comprises of complete details of welding joint for a problem from industry.

B) INDUSTRIAL EXPOSURE:

Sr. No.	Mode of Exposure	Topic
1	Industrial Visit	Gas Welding.
2	Industrial Visit	Gas shield arc welding.

C) THEORY

SECTION – I

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course outcome: MEG509.1-Distinguish different welding processes. **MEG509.2-**Select proper welding process for given job **MEG509.3-** Demonstrate various types of welding processes **MEG509.4-** Interpret welding drawing **MEG509.5**–Follow safe practices in welding operations.			
1.	**GAS SHIELD ARC WELDING** 1.1 Introduction 1.2 Equipments 1.3 TIG operation 1.4 MIG operation. 1.5 Applications.	**24**	**40**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

SECTION – II

Sr. No	Topics	Teaching (Hours)	Theory evaluation Marks
Course outcome: MEG509.1-*Distinguish different welding processes*. **MEG509.2-**Select proper welding process for given job **MEG509.3-** Demonstrate various types of welding processes **MEG509.4-** Interpret welding drawing **MEG509.5**–Follow safe practices in welding operations.			
2.	**GAS WELDING**. 2.1 Introduction 2.2 Equipments 2.3 Operation 2.4 Joining Processes. 2.5 Oxygen Fuel Cutting. 2.6 Application.	**12**	**20**

3.	**OTHER WELDING PROCESSES** 3.1 Plasma Arc Welding. 3.2 Resistance Welding. 3.3 Electron Welding. 3.4 Laser Welding. 3.5 Thermit Welding. 3.6 Metal Flame Spraying. 3.7 Solid State Bonding. 3.8 Application of Each Type.	**12**	**20**
	Total	**24**	**40**
Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.			

7. SPECIFICATION TABLE FOR SETTING QUESTION PAPER FOR SEMESTER END THEORY EXAMINATION:

Section / Topic no.	Name of topic	Distribution of marks (level wise)			Total marks
		Knowledge	Comprehension	Application	
1	Gas shield arc welding.	12	12	16	40
2	Gas Welding.	06	06	08	20
3	Other Welding Processes.	06	06	08	20
Total		24	24	32	80

Semester end exam question paper should be such that total marks of questions on each topic is one and half times the marks allotted above but the candidates are able to attempt questions of the above allotted marks only.

8. ASSESSMENT CRITERIA FOR TERM WORK:

i) Continuous Assessment of Practical Assignments:

Every practical assignment shall be assessed for 25 marks as per following criteria:

Sr. No	Criteria	Marks allotted
1	Attendance at regular practical	5
2	Preparedness for practical	5
3	Correct figures / diagrams	3
4	Observation tables	5
5	Result table / calculations / graphs	5
6	Safety / use of proper tools	2
	Total	25

The average of all the practical marks will be considered as marks out of 25 as per *Assessment Pro-forma III.*

ii) Progressive Skill Test:

One mid-term *Progressive Skill Test* of 25 marks shall be conducted.

Final marks of term work shall be awarded as per *Assessment Pro-forma III.*

iii) End semester Practical Examination:

Term-end Practical Examination (External) shall be conducted by internal-external examiners as per the following assessment criteria and marks to be added in *Proforma-III*:

Sr. No.	Criteria	Marks allotted
1	Quality and neatness of term work	05
2	Participation	05
3	Understanding	05
4	Representation	05
5	Safety / use of proper tools	05
	Total	**25**

9. INSTRUCTIONAL STRATEGIES

Instructional methods

i) Lectures and discussions.
ii) Laboratory experiences and laboratory interactive sessions.
iii) Time bound assignments.
iv) Industrial Visits

Teaching and Learning resources, including references:

i) Chalk-board.
ii) Demonstrative kits.
iii) Demonstrative charts.
iv) LCD Projector

10. REFERENCE MATERIAL:

a) Books:

Sr. No.	Author	Name of the Book	Publication
1	Richard L. Little	Welding & Welding Technology	Tata McGraw-Hill.
2	Mohler Rudy	Practical Welding	Industrial Press Inc.

b) Website

i) www.swikuo.com
ii) www.workshopmachinery.com
iii) www.sodick.com/
iv) www.terprisemachinery.co.uk/

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