

SRI RAMAKRISHNA MISSION VIDYALAYA
POLYTECHNIC COLLEGE
(AN AUTONOMOUS & ISO 9001:2008 CERTIFIED INSTITUTION)

CURRICULUM AND SYLLABUS

(APPLICABLE TO STUDENTS ADMITTED FROM
2016 - 2017 ACADEMIC YEAR ONWARDS)
(R5 – SCHEME)

DIPLOMA IN MECHANICAL ENGINEERING
(SECOND AND THIRD YEAR)



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R5 - SCHEME : R E G U L A T I O N S

(For Second Year and Third Year)

Description of the Course:

The Course for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters. This Curriculum for the Diploma Course is applicable for the candidates admitted in first year from 2016-2017 academic year onwards.

Eligibility for the Award of Diploma:

No candidate shall be eligible for the Diploma unless he has undergone the prescribed course of study in this College for a period of not less than 3 academic years when joined in first year and two years if joined under lateral entry scheme in the second year and passed the prescribed examination. The minimum and maximum period for completion of Diploma course is as given below:

Diploma Course	Minimum Period	Maximum Period
Full Time Regular	3 Years	6 Years
Full Time(Lateral Entry)	2 Years	5 Years

Age Limit: No age limit

Curriculum and Subjects of Study:

The curriculum and subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical subjects.

Examinations:

Autonomous Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester. The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment and 75 marks are allotted for final external Autonomous examination.

Continuous Internal Assessment Marks:

A. FOR THEORY SUBJECTS:

The internal assessment marks for a total of 25 marks, which are to be distributed as follows:

a)	Subject Attendance	05 marks
b)	Assignments	05 marks
c)	Seminar	05 marks
d)	Continuous Assessment Tests	05 marks
e)	Model Examination	05 marks
	TOTAL	25 Marks

a) Subject Attendance**05 Marks**

(Award of marks for subject attendance to each theory subject is as per the range given below)

80%	-	83%	} 1 Mark 2 Marks 3 Marks 4 Marks 5 Marks
84%	-	87%	
88%	-	91%	
92%	-	95%	
96%	-	100%	

b) Assignments**05 Marks**

For each theory subject three assignments are to be given and the average marks scored is reduced to 05 marks.

c) The Material submitted as well as Seminar presentation**05 Marks**

The students will be given topics either from the subjects (excluding the topics available in the syllabus) or general topics which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present the seminar (for the 3rd and 4th semesters, the students will be permitted to present the seminar as a group not exceeding six members and for the 5th and 6th semester students will present the seminar individually).

The concerned subject teacher will suggest topics and will evaluate the submitted materials and seminar presentation. (2.5 marks for the material submitted in writing and 2.5 marks for the seminar presentation). For each subject a minimum of two topics are given and the average marks scored is reduced to 05 marks.

d) Continuous Assessment Tests**05 Marks**

Two Continuous Assessment Tests (CAT), each of 2 hours duration for a total of 50 marks, are conducted. The **average of these two test marks** is taken and the marks are reduced to 05.

e) Model Examination**05 Marks**

Model Examination is conducted covering all the five units of 3 hours duration as per the end semester Autonomous examination question paper pattern for a total of 75 marks. The mark obtained is reduced to 05 Marks.

Test	Units	When to conduct	Marks	Duration
CAT - I	Unit - I & II	End of 6 th week	50	2 Hrs
CAT - II	Unit - III & IV	End of 12 th week	50	2 Hrs
Model Exam	Covering all the 5 Units (End Semester Exam question paper pattern)	End of 15 th week	75	3 Hrs

END SEMESTER AUTONOMOUS EXAMINATION - QUESTION PAPER PATTERN
(Question paper pattern common to all theory subjects unless it is specified)

PART A - (1 to 8)

Five Questions are to be answered out of **eight** questions for 2 marks each. (Question No. 8 will be the compulsory question and can be asked from any one of the units) (From each unit maximum of two 2 marks questions alone can be asked)

PART B - (9 to 16)

Five Questions are to be answered out of **eight** questions for 3 marks each. (Question No. 16 will be the compulsory question and can be asked from any one of the units) (From each unit maximum of two 3 marks questions alone can be asked)

PART C - (17 to 21)

Five Questions will be asked from each unit in the **either - or** pattern. Students have to answer all the five questions. Each question carries 10 marks. (Based on the discretion of the question setter, he/she can ask two five mark questions (with sub division A & sub division B) instead of one ten marks question, if required)

*Any tables required, should be mentioned in the question paper like
Steam table, IS Code Book, Steel table, Design Data Book, Mollier chart,
Psychometric Chart etc.,*

B. FOR PRACTICAL SUBJECTS:

The internal assessment mark for a total of 25 marks which are to be distributed as follows:-

a)	Practical Attendance	05 Marks
b)	Procedure / observation and tabulation / other practical related works	10 Marks
c)	Record writing	10 Marks
	TOTAL	25 Marks

Award of marks for attendance to each practical subject is as per the range given below.

80%	-	83%	} 1 Mark 2 Marks 3 Marks 4 Marks 5 Marks
84%	-	87%	
88%	-	91%	
92%	-	95%	
96%	-	100%	

Note:

- All the Experiments / Exercises indicated in the syllabus should be completed and the same to be given for final Autonomous end semester examinations.
- The Record for every completed exercise should be submitted in the subsequent Practical classes and marks should be awarded for 20 for each exercise as per the above allocation.
- At the end of the semester, the average marks of all the exercises calculated for 20 marks and the marks awarded for attendance is added to arrive at the internal assessment. ($20 + 5 = 25$)
- The students have to submit duly signed bonafide record note books / files during the Exam.
- All the marks awarded for Assignments, Tests, Practical exercise marks and Attendance are entered in the Personal Log Book of the staff, who handles the subject. This is applicable to both, Theory and Practical subjects.

C. PROJECT WORK:

The students have to do a project work in the final semester as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training. The project work must be reviewed twice in a semester.

i) Internal Assessment Marks:

The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Details of Assessment	Period of Assessment	Max. Marks
First Review	06 th week	10
Second Review	12 th week	10
Attendance (same as Theory / Practical)	Entire semester	05
Total		25

ii) End Semester Exam:

A neatly prepared PROJECT REPORT as per the format is submitted by individual student during the project work & viva-voce end semester examinations.

Details of mark allocation	Max. Marks
Report Preparation, Demo, Viva-voce	60 Marks
4 questions from question bank consisting of Entrepreneurship, Environmental Management and Disaster Management will be asked. Out of four questions the students have to write any two questions from each topic. 2 questions x 3 topics = 6 questions (6 x 2 ½ = 15 Marks)	15 Marks
Total	75 Marks

Award of Diploma:**Classification of successful candidates:**

Classification of candidates who will pass out the final examinations from April 2019 onwards (Joined in first year in 2016-2017 academic year) in R5-scheme is being done as specified below.

First Class with Superlative Distinction:

A candidate will be declared to have passed in **First Class with Superlative Distinction**, if he secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all subjects within the stipulated period of study of 3 / 2 years (3 years for regular entry / 2 years for lateral entry) without any break.

First Class with Distinction:

A candidate will be declared to have passed in **First Class with Distinction**, if he secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all subjects within the stipulated period of study of 3 / 2 years (3 years for regular entry 2 years for lateral entry) without any break.

First Class:

A candidate will be declared to have passed in **First Class**, if he secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within the stipulated period of study 3 / 2 years (3 years for regular entry / 2 years for lateral entry) without any break.

Second Class:

All other successful candidates will be declared as pass in **Second Class**.

Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he has undergone the prescribed course of study successfully and pass all the subjects prescribed in the curriculum.
2. A candidate shall be declared to have passed the examination in a subject if he secures not less than 40% in theory subjects and 50% in practical subjects out of the total prescribed maximum marks including both the Internal Assessment and the End semester Examinations marks put together, subject to the condition that he secures at least a minimum of 30 marks out of 75 marks in the Theory Examinations and a minimum of 35 marks out of 75 marks in the Practical Examinations.

Duration of a period in the Class Time Table:

The duration of each period of instruction is 01 hour and the total period of instruction hours excluding interval and lunch break in a day should be 07 hours corresponding to 07 periods of instruction (Theory & Practical).

Autonomous Examination - Exam Pattern:

Autonomous Examinations for all the Diploma Courses are being conducted in the following Pattern:

Semester	Span of Study	Examination
I, III & V Sem	June - October	October
II, IV & VI Sem	December - April	April

Requirements to appear for Examinations:

A candidate will be permitted to appear for the Autonomous examinations, only if he secures a minimum of overall 80% attendance in the semester concerned.

Condonation of Attendance:

The minimum overall percentage of attendance required for a candidate to become eligible to write the Autonomous end semester examination is 80%. Under extraordinary circumstances, for genuine and valid reasons, Medical reasons, the Principal may condone up to a maximum of 10% shortage to a candidate, subject to the condition that he satisfies all the other requirements to appear for the Autonomous Examination. Under no circumstances a candidate with attendance less than 70% shall be permitted to write the Autonomous Examinations. The condonement of 10% shortage shall not be done as a routine to all candidates, but only for genuine cases; it shall not be claimed as a matter of right by all candidates.

DIPLOMA IN MECHANICAL ENGINEERING CURRICULUM OUTLINE

THIRD SEMESTER:

Subject Code	Name of Subject	Hours per week			
		Theory	Tutorial / Drawing	Practical	Total
R5-321	Strength of Materials	6	-	-	6
R5-322	Manufacturing Processes	5	-	-	5
R5-323	Fluid Mechanics and Fluid Power	5	-	-	5
R5-324	Machine Drawing	-	6	-	6
R5-325	Strength of Materials and Fluid Mechanics Practical	-	-	4	4
R5-326	Lathe, Drilling and Foundry Practical	-	-	4	4
R5-327	Computer Applications Practical	-	-	4	4
Library cum Seminar		1	-	-	1
TOTAL		17	6	12	35

FOURTH SEMESTER:

Subject Code	Name of Subject	Hours per week			
		Theory	Tutorial / Drawing	Practical	Total
R5-421	Heat Power Engineering	6	-	-	6
R5-422	Special Machines	5	-	-	5
R5-423	Electrical Drives and Control	5	-	-	5
R5-424	Computer Aided Machine Drawing Practical	-	6	-	6
R5-425	Metrology and Metallography Practical	-	-	4	4
R5-426	Special Machines Practical	-	-	4	4
R5-427	Electrical Drives and Control Practical	-	-	4	4
Library cum Seminar		1	-	-	1
TOTAL		17	6	12	35

FIFTH SEMESTER:

Subject Code	Name of Subject	Hours per week			
		Theory	Tutorial / Drawing	Practical	Total
R5-521	Thermal Power Engineering	6	-	-	6
R5-522	Design of Machine Elements	6	-	-	6
R5-523	Process Planning and Cost Estimation	5	-	-	5
R5-524.1	Elective Theory - I: Automobile Engineering	5	-	-	5
R5-524.2	Elective Theory - I: Foundry Technology				
R5-524.3	Elective Theory - I: Refrigeration and Air Conditioning				
R5-525	Thermal Power Engineering Practical	-	-	4	4
R5-526.1	Elective Practical - I: Automobile Engineering Practical	-	-	4	4
R5-526.2	Elective Practical - I: Foundry Technology Practical				
R5-526.3	Elective Practical - I: Refrigeration and Air Conditioning Practical				
R5-527	Life and Employability Skills Practical	-	-	4	4
Library cum Seminar		1	-	-	1
TOTAL		23	-	12	35

SIXTH SEMESTER:

Subject Code	Name of Subject	Hours per week			
		Theory	Tutorial / Drawing	Practical	Total
R5-621	Industrial Engineering and Management	6	-	-	6
R5-622	Computer Aided Design and Manufacturing	5	-	-	6
R5-623.1	Elective Theory - II: Welding Technology	5	-	-	5
R5-623.2	Elective Theory - II: Robotics				
R5-623.3	Elective Theory - II: Mechanical Instrumentation				
R5-624	Computer Aided Design and Manufacturing Practical	-	-	6	6
R5-625	Machine Tool Testing and Maintenance Practical	-	-	4	4
R5-626.1	Elective Practical - II: Welding Technology Practical	-	-	4	4
R5-626.2	Elective Practical - II: Robotics Practical				
R5-626.3	Elective Practical - II: Mechanical Instrumentation Practical				
R5-627	Project Work	-	-	4	4
Library cum Seminar		1	-	-	1
TOTAL		17	-	18	35

SCHEME OF EXAMINATIONS

Subject Code	Name of Subject	Periods Per Week	Periods per Semester (15 weeks)	Scheme of Examination				
				Exam Duration in Hrs	Allocation of Marks			Minimum for Pass
					Internal	External	Total	
THIRD SEMESTER								
R5-321	Strength of Materials	6	90	3	25	75	100	40
R5-322	Manufacturing Processes	5	75	3	25	75	100	40
R5-323	Fluid Mechanics and Fluid Power	5	75	3	25	75	100	40
R5-324	Machine Drawing	6	90	3	25	75	100	40
R5-325	Strength of Materials and Fluid Mechanics Practical	4	60	3	25	75	100	50
R5-326	Lathe, Drilling and Foundry Practical	4	60	3	25	75	100	50
R5-327	Computer Applications Practical	4	60	3	25	75	100	50
FOURTH SEMESTER								
R5-421	Heat Power Engineering	6	90	3	25	75	100	40
R5-422	Special Machines	5	75	3	25	75	100	40
R5-423	Electrical Drives and Control	5	75	3	25	75	100	40
R5-424	Computer Aided Machine Drawing Practical	6	90	3	25	75	100	50
R5-425	Metrology and Metallography Practical	4	60	3	25	75	100	50
R5-426	Special Machines Practical	4	60	3	25	75	100	50
R5-427	Electrical Drives and Control Practical	4	60	3	25	75	100	50

Subject Code	Name of Subject	Periods Per Week	Periods per Semester (15 weeks)	Scheme of Examination				
				Exam Duration in Hrs	Allocation of Marks			Minimum for Pass
					Internal	External	Total	
FIFTH SEMESTER								
R5-521	Thermal Power Engineering	6	90	3	25	75	100	40
R5-522	Design of Machine Elements	6	90	3	25	75	100	40
R5-523	Process Planning and Cost Estimation	5	75	3	25	75	100	40
R5-524.1	Elective Theory - I: Automobile Engineering	5	75	3	25	75	100	40
R5-524.2	Elective Theory - I: Foundry Technology							
R5-524.3	Elective Theory - I: Refrigeration and Air Conditioning							
R5-525	Thermal Power Engineering Practical	4	60	3	25	75	100	50
R5-526.1	Elective Practical - I: Automobile Engineering Practical	4	60	3	25	75	100	50
R5-526.2	Elective Practical - I: Foundry Technology Practical							
R5-526.3	Elective Practical - I: Refrigeration and Air Conditioning Practical							
R5-527	Life and Employability Skills Practical	4	60	3	25	75	100	50
SIXTH SEMESTER								
R5-621	Industrial Engineering and Management	6	90	3	25	75	100	40
R5-622	Computer Aided Design and Manufacturing	5	75	3	25	75	100	40
R5-623.1	Elective Theory - II: Welding Technology	5	75	3	25	75	100	40
R5-623.2	Elective Theory - II: Robotics							
R5-623.3	Elective Theory - II: Mechanical Instrumentation							
R5-624	Computer Aided Design and Manufacturing Practical	6	90	3	25	75	100	50
R5-625	Machine Tool Testing and Maintenance Practical	4	60	3	25	75	100	50
R5-626.1	Elective Practical - II: Welding Technology Practical	4	60	3	25	75	100	50
R5-626.2	Elective Practical - II: Robotics Practical							
R5-626.3	Elective Practical - II: Mechanical Instrumentation Practical							
R5-627	Project Work	4	60	3	25	75	100	50

R5-SCHEME GENERAL EVALUATION PATTERN (THEORY)

External Examination	-	075 marks
Internal Assessment	-	025 marks
Total	-	100 marks

Condition for pass:

1. In external exam minimum **30** out of **75** marks
2. In internal there is **no** minimum
3. Internal + External must be **40** percent for pass.

Evaluation of Internal Assessment Marks:

The Internal Assessment marks for a total of 25 marks which are distributed as follows:-

a)	Subject Attendance	05 marks
b)	Assignments	05 marks
c)	Seminar	05 marks
d)	Continuous Assessment Tests	05 marks
e)	Model Examination	05 marks
	TOTAL	25 Marks

a) Subject Attendance

05 Marks

(Award of marks for subject attendance to each Theory subject is as per the range given below)

80%	-	83%	}	1 Mark
84%	-	87%		2 Marks
88%	-	91%		3 Marks
92%	-	95%		4 Marks
96%	-	100%		5 Marks

b) Assignments

05 Marks

For each theory subject three assignments are to be given and the average marks scored is reduced to 05 marks.

c) The Material submitted as well as Seminar presentation

05 Marks

The students will be given topics either from the subjects (excluding the topics available in the syllabus) or general topics which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present the seminar (for the 3rd and 4th semesters, the students will be permitted to present the seminar as a group not exceeding six members and for the 5th and 6th semester students will present the seminar individually).

The concerned subject teacher will suggest topics and will evaluate the submitted materials and seminar presentation. (2.5 marks for the material submitted in writing and 2.5 marks for the seminar presentation). For each subject a minimum of two topics are given and the average marks scored is reduced to 05 marks.

d) Continuous Assessment Tests

05 Marks

Two Continuous Assessment Tests (CAT), each of 2 hours duration for a total of 50 marks, are conducted. The **average of these two test marks** is taken and the marks are reduced to 05.

e) Model Examination**05 Marks**

Model Examination is conducted covering all the five units of 3 hours duration as per the End Semester Autonomous Examination question paper pattern for a total of 75 marks. The mark obtained is reduced to 5 Marks.

Test	Units	When to conduct	Marks	Duration
CAT-I	Unit - I & II	End of 6 th week	50	2 Hrs
CAT-II	Unit - III & IV	End of 12 th week	50	2 Hrs
Model Exam	Covering all the 5 Units. (End Semester Exam question paper pattern)	End of 15 th week	75	3 Hrs

END SEMESTER AUTONOMOUS EXAMINATION - QUESTION PAPER PATTERN

(Question paper pattern common to all theory subjects unless it is specified)

PART A - (1 to 8)

Five Questions are to be answered out of **eight** questions for 2 marks each. (Question No. 8 will be the compulsory question and can be asked from any one of the units) (From each unit maximum of two 2 marks questions alone can be asked)

PART B - (9 to 16)

Five Questions are to be answered out of **eight** questions for 3 marks each. (Question No. 16 will be the compulsory question and can be asked from any one of the units) (From each unit maximum of two 3 marks questions alone can be asked)

PART C - (17 to 21)

Five Questions will be asked from each unit in the **EITHER - OR** pattern. Students have to answer all the five questions. Each question carries 10 marks. (Based on the discretion of the question setter, he/she can ask two five mark questions (with sub division A & sub division B) instead of one ten marks question, if required)

* Any tables required, should be mentioned in the question paper like Steam table, Design Data Book, Mollier chart, Psychometric Chart etc.,

R5-SCHEME GENERAL EVALUATION PATTERN (PRACTICAL)

External Examination	-	075 marks
Internal Assessment	-	025 marks
Total	-	100 marks

Condition for pass:

1. In external practical exam minimum **35** out of **75** marks
2. In internal there is **no** minimum
3. Internal + External must be **50** percent for pass.

Evaluation of Internal Assessment Marks:

The Internal Assessment marks for a total of 25 marks which are to be distributed as follows:-

a)	Practical Attendance	05 Marks
b)	Procedure / observation and tabulation / other practical related works	10 Marks
c)	Record writing	10 Marks
	TOTAL	25 Marks

Award of marks for attendance to each practical subject is as per the range given below.

80%	-	83%	}	1 Mark
84%	-	87%		2 Marks
88%	-	91%		3 Marks
92%	-	95%		4 Marks
96%	-	100%		5 Marks

Note:

- All the Experiments / Exercises indicated in the syllabus should be completed and the same to be given for final Autonomous end semester examinations.
- The Record for every completed exercise should be submitted in the subsequent Practical classes and marks should be awarded for 20 for each exercise as per the above allocation.
- At the end of the semester, the average marks of all the exercises calculated for 20 marks and the marks awarded for attendance is added to arrive at the internal assessment. ($20 + 5 = 25$)
- The students have to submit duly signed bonafide record note books / files during the Exam.
- All the marks awarded for Assignments, Tests, Practical exercise marks and Attendance are entered in the Personal Log Book of the staff, who handles the subject. This is applicable to both, Theory and Practical subjects.

Project Work:

The students have to do a project work in the final semester as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training. The project work must be reviewed twice in a semester.

a) Internal Assessment:

The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Details of Assessment	Period of Assessment	Max. Marks
First Review	06 th week	10
Second Review	12 th week	10
Attendance (same as Theory / Practical)	Entire semester	05
Total		25

b) End Semester Exam:

A neatly prepared PROJECT REPORT as per the format is submitted by individual student during the project work & viva-voce end semester examinations.

Details of mark allocation	Max. Marks
Report Preparation, Demo, Viva-voce	60 Marks
4 questions from question bank consisting of Entrepreneurship, Environmental Management and Disaster Management will be asked. Out of four questions the students have to write any two questions from each topic. 2 questions x 3 topics = 6 questions ($6 \times 2 \frac{1}{2} = 15$ Marks)	15 Marks
Total	75 Marks

DETAILED SYLLABUS THIRD SEMESTER R5-321 STRENGTH OF MATERIALS

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-321 STRENGTH OF MATERIALS	Hours / Week	Hours / Sem	Marks			Duration
	6 Hrs	90 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	STATICS OF PARTICLES AND FRICTION	16
II	DEFORMATION OF METALS	16
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	16
IV	SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING	16
V	TORSION AND SPRINGS	16
Total Instruction Hours		80

UNIT - I

STATICS OF PARTICLES

16 Hrs

Introduction – Force – effects of a force – system of forces – resultant of force – principle of transmissibility – parallelogram law of forces – triangular law – resultant of several forces acting on a particle – polygon law – resolution of a force into rectangular components – resultant of a system of forces acting on a particle using rectangular components – equilibrium of particles – external and internal forces – moment of a force – Varignon's theorem – moment of a couple – equivalent couples – addition of couples – resolution of a force into a force and a couple – free body diagram – necessary and sufficient conditions for the equilibrium of rigid bodies in two dimension – support reaction – types of support – removal of two dimensional supports – simple problems

Friction: Introduction – definition – force of friction – limiting friction – static friction – dynamic friction – angle of friction – co-efficient of friction – Laws of static and dynamic friction

UNIT - II

DEFORMATION OF METALS

16 Hrs

Mechanical properties of materials: Engineering materials – ferrous and nonferrous materials – definition of mechanical properties such as strength – elasticity, plasticity, ductility, malleability, stiffness, toughness, brittleness, hardness, wear resistance, machinability, castability and weldability – alloying elements – effect of alloying element – fatigue, fatigue strength, creep – temperature creep – cyclic loading and repeated loading – endurance limit

Simple stresses and strains: Definition – load, stress and strain – classification of force systems – tensile, compressive and shear force systems – behavior of mild steel in tension up to rupture – stress-strain diagram – limit of proportionality – elastic limit – yield

stress – breaking stress – ultimate stress – percentage of elongation and percentage reduction in area – Hooke's law – definition – Young's modulus – working stress, factor of safety, load factor, shear stress and shear strain – modulus of rigidity. Linear strain – deformation due to tension and compressive force – simple problems in tension, compression and shear force

Definition – lateral strain – Poisson's ratio – volumetric strain – bulk modulus –volumetric strain of rectangular and circular bars – problems connecting linear, lateral and volumetric deformation – elastic constants and their relationship – problems on elastic constants – definition – composite bar – problem in composite bars subjected to tension and compression – temperature stresses and strains – simple problems – definition – strain energy – proof resilience – modulus of resilience – expression for strain energy stored in a bar due to axial load – Instantaneous stresses due to gradual, sudden, impact and shock loads – problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings

UNIT - III

GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS

16 Hrs

Properties of sections: Definition – center of gravity and centroid – position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium – problems to determine the centroid of angle, channel, T and I sections only – definition – centroidal axis – axis of symmetry.

Moment of Inertia – statement of parallel axis theorem and perpendicular axis theorem – Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections – definition – polar moment of Inertia – radius of gyration – problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections

Thin Shells: Definition – thin and thick cylindrical shell – failure of thin cylindrical shell subjected to internal pressure – derivation of hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell subjected to internal pressure – problems – derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems

UNIT - IV

SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING

16 Hrs

Classification of beams – definition – slope, deflection, stiffness and flexural rigidity – shear force and bending moment – sign conventions for shear force and bending moment – types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (UDL) – determination of maximum bending moment in cantilever beam and simply supported beam when subjected to point load and uniformly distributed load

Theory of simple bending – assumptions – neutral axis – bending stress distribution – moment of resistance – bending equation – $M/I = f/y = E/R$ – definition – section modulus – rectangular and circular sections – strength of beam – simple problems involving flexural formula for cantilever and simple supported beam

UNIT - V

TORSION AND SPRINGS

16 Hrs

Theory of torsion – assumptions – torsion equation – strength of solid and hollow shafts – power transmitted – definition – Polar modulus – torsional rigidity – strength and

stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations – advantages of hollow shafts over solid shafts – problems
Types of springs – laminated and coiled springs and applications – types of coiled springs – difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs

Text Books:

- 1) Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi – 2002
- 2) Strength of Materials, S. Ramamrutham, 15th Edn 2004, Dhanpat Rai Pub. Co., New Delhi.

Reference Books:

- 1) Strength of Materials, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
- 2) Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi, 2008, ISBN9780070668959,
- 3) Strength of Materials, B K Sarkar, I Edition, 2003 Tata Mcgraw hill, New Delhi.
- 4) Engineering Mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007
- 5) Strength of Materials, RYDER.G.H., Mcmillen India.

Instruction Hours	80 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	90 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-322 MANUFACTURING PROCESSES

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
R5-322 MANUFACTURING PROCESSES			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	FOUNDRY TECHNOLOGY	13
II	WELDING TECHNOLOGY	13
III	FORMING TECHNOLOGY	13
IV	THEORY OF METAL CUTTING & LATHE	13
V	DRILLING & METROLOGY	13
Total Instruction Hours		65

UNIT - I FOUNDRY TECHNOLOGY

13 Hrs

Patterns: Definition – types of pattern – solid pattern – split pattern - loose piece – match plate - sweep - skeleton – segmental – shell – pattern materials – pattern allowances- factors for selecting pattern materials

Moulding: Moulding sand – constituents – types – properties of moulding sand – moulding sand preparation – moulding tools – moulding boxes – types of moulds – Green sand mould – Dry sand mould – Loam mould – Bench and floor moulding– moulding machines – Jolting – Squeezing – Sand slinger (construction and working principle only)

Cores: Essential qualities of core – materials – core sand preparation – core binders – core boxes - CO2 process core making – types of core

Metallurgy: Introduction – Iron-carbon diagram.

Melting furnaces: Blast furnace – Cupola furnace – Crucible furnace – types – Pit furnace – coke fired – oil fired – Electric furnace – types – direct arc – indirect arc – Induction furnace – working principles – instruments for measuring the temperature – Optical pyrometer, Thermo electric or Thermo couple pyrometer

Casting: Shell mould casting – Investment casting – Pressure die casting – Hot chamber die casting – Cold chamber die casting – Gravity die casting – Centrifugal casting – Continuous casting – cleaning of casting – defects in casting – causes and remedies

UNIT - II WELDING TECHNOLOGY

13 Hrs

Arc Welding: Definition – Arc welding equipment – electrode types – filler and flux materials – arc welding methods – metal arc - Metal Inert Gas (MIG) – Tungsten Inert Gas (TIG) – Submerged arc – Plasma arc welding – Electro slag welding – Resistance welding – Spot welding – Butt welding – Seam welding – Plasma arc welding – Thermit welding – Electron beam welding – Laser beam welding – Friction welding – Ultrasonic welding – Induction welding – working principle – applications – advantages and disadvantages

Gas welding: Oxy-acetylene welding – advantages - limitations – gas welding equipment – three types of flames – welding techniques – filler rods – flame cutting – soldering – brazing – difference between soldering and brazing

Types of welded joints – merits and demerits of welded joints – inspection and testing of welded joints – destructive and non-destructive types of tests – magnetic particle test – radiographic and ultrasonic test – defects in welding – causes and remedies

UNIT - III FORMING TECHNOLOGY

13 Hrs

Forging: Hot working, cold working (definition only) – advantages of hot working and cold working – hot working operations – rolling, forging, smith forging, drop forging, upset forging, press forging – roll forging – extrusion (direct, indirect and tube)

Press Working: Types of presses – mechanical and hydraulic presses –types of drives- press tools and accessories – press working operations – bending operations – angle bending – channel bending – curling – drawing – shearing operations – blanking – piercing – trimming – notching – lancing

Powder Metallurgy: Methods of manufacturing metal powders – atomization, reduction and electrolysis deposition – compacting – sintering – sizing – infiltration – mechanical

properties of parts made by powder metallurgy – design rules for the powder metallurgy process

UNIT - IV

THEORY OF METAL CUTTING & LATHE

13 Hrs

Introduction – orthogonal cutting – oblique cutting – single point cutting tool – nomenclature – types of chips – chip breakers – cutting tool materials – properties – tool wears – factors affecting tool life – cutting fluids – functions – properties of cutting fluid

Centre Lathe: Introduction – specifications – simple sketch – principal parts – head stock – back geared type – all geared type – feed mechanism – tumbler gear mechanism – quick change gear box – apron mechanism – work holding device – three jaw chuck – four jaw chuck – Centres – Face plate – Mandrel – Steady rest – Follower rest – machining operations done on lathe – straight turning – step turning – taper turning methods: form tool – tailstock set over method – compound rest method – taper turning attachment – Knurling – Thread cutting – Facing – Boring – Chamfering – Grooving – Parting-off – Eccentric turning – cutting speed – feed – depth of cut – metal removal rate

Semi-Automatic Lathes: Types of semi-automatic lathes – Capstan and Turret lathes – Geneva indexing mechanism – Bar feeding mechanism – difference between turret and capstan – work holding devices – tool holders

UNIT - V

DRILLING AND METROLOGY

13 Hrs

Drilling Machines: Drills – Flat drills – Twist drills – nomenclature of twist drill – types of drilling machines – bench type – floor type – radial type – Gang drill – multi spindle type – principle of operation in drilling – methods of holding drill bit – drill chucks – socket and sleeve – drilling operation – Reaming – Counter sinking – Counter boring – Spot facing – Tapping – Deep hole drilling

Metrology: Definition – need of inspection – precision – accuracy – sensitivity – magnification – repeatability – calibration – comparator – Advantages – requirements – Mechanical comparator – Optical comparator – Electrical comparator – Pneumatic comparator – principles – advantages and disadvantages

Measuring instruments: Construction and principles only – Steel rule – Callipers: Outside caliper – Inside caliper – Jenny caliper – Combination set – Feeler gauge – Pitch screw gauge – Vernier caliper – Digital caliper – Vernier height gauge – Micrometer – Inside micrometer – Thread micrometer – Slip gauges – requirement – Indian standard – care and use – Sine bar – types – uses – limitations – working principle of Clinometers, Autocollimator, Angle dekkor

Text Books:

- 1) Elements of Workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya – 11th Edition - Media Promoters & Publishers Pvt. Ltd., Mumbai 400 007 – 2007.
- 2) Introduction of Basic Manufacturing Processes and Workshop Technology – Rajender Singh – New age International (P) Ltd. Publishers, New Delhi - 110002

Reference Books:

- 1) Manufacturing Processes – Begeman – 5 th Edition -McGraw Hill, New Delhi 1981
- 2) Workshop Technology – WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd., New Delhi 110 002
- 3) Workshop Technology – Raghuwanshi - Khanna Publishers, New Delhi
- 4) Production Technology – Jain & Gupta, Edn. XII, Khanna Publishers, New Delhi 110 006 - 2006
- 5) Production Technology – P. C. Sharma - Edn. X - S.Chand & Co. Ltd., New Delhi 110 055 - 2006
- 6) Production Technology – HMT - Edn. 18 - Tata McGraw Hill pub. Co. Ltd., New Delhi 110 008. – 2001

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-323 FLUID MECHANICS AND FLUID POWER

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-323 FLUID MECHANICS AND FLUID POWER	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS	13
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES	13
III	IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	13
IV	PNEUMATIC SYSTEMS & PNEUMATIC DEVICES	13
V	HYDRAULIC SYSTEMS	13
Total Instruction Hours		65

UNIT- I

PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS

13 Hrs

Introduction – definition of fluid – classification of fluids – ideal and real fluids – properties of a fluid – definition and units – Pressure – units of pressure – pressure head – atmospheric, gauge and absolute pressure – problems – Pascal's law – proof – applications of Pascal's law – hydraulic press – hydraulic jack – pressure measurement – Piezometer tube – simple U-tube manometer – Differential U-tube manometer – inverted differential manometer – micro manometer – inclined tube micro-manometer – mechanical gauges – Bourdon's tube pressure gauge – Diaphragm pressure gauge – Dead weight pressure gauge

UNIT- II

FLOW OF FLUIDS AND FLOW THROUGH PIPES

13 Hrs

Types of fluid flow – path line and stream line – mean velocity of flow – discharge of a flowing fluid – equation of continuity of fluid flow – energies of fluid – Bernoulli's theorem – statement – assumptions and proof – applications and limitations of Bernoulli's theorem – problems on Bernoulli's theorem – venturimeter – derivation for discharge – orifice meter – derivation for discharge – difference between venturimeter and orificemeter – problems on venturimeter and orificemeter – Pitot tube – description only – Orifice – types – applications – hydraulic co-efficients – determining hydraulic co-efficient – experimental method of finding C_v , C_c and C_d – problems – discharge through a small orifice discharging freely only – problems – mouthpiece – description only
 Flow through pipes: Laws of fluid friction – hydraulic gradient line – total energy line – wetted perimeter – hydraulic mean radius – loss of head due to friction – Darcy-Weisbach equation and Chezy's formula – problems – minor losses (description only) – power transmission through pipes – problems

UNIT- III

IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS

13 Hrs

Impact of jet – on a stationary flat plate held normal to the jet and inclined to the direction of jet – impact of jet on a flat plate moving in the direction of jet – Impact of jet on a series of moving plates or vanes – force exerted and work done by the jet – problems
 Hydraulic turbines – classifications – Pelton wheel – components and working – speed regulation (theory only) – Francis and Kaplan turbines – components and working – draft tube – functions and types – surge tank – differences between impulse and reaction turbines
 Centrifugal pumps – classifications – construction and working of single stage centrifugal pump – components with types – theory only – multi-stage pumps – advantages – priming – cavitation
 Reciprocating pumps – classifications – construction and working of single acting and double acting reciprocating pumps – plunger and piston pumps – discharge of a reciprocating pump – theoretical power required – coefficient of discharge – slip – problems – negative slip – indicator diagram – separation – air vessel (functions and working) – Special pumps – Jet pump – Turbine pump – Submersible pump

UNIT- IV

PNEUMATIC SYSTEMS & PNEUMATIC DEVICES

13 Hrs

Pneumatic systems – elements – filter – regulator – lubricator unit – pressure control valves – pressure relief valves – pressure regulation valves – Directional Control Valves (DCV) – 3/2 DCV – 4/2 DCV – 4/3 DCV – 5/2 DCV – 5/3 DCV – flow control valves – throttle valves – shuttle valves – quick exhaust valves – ISO symbols of pneumatic components – pneumatic circuits – direct control of single acting cylinder – operation of double acting cylinder – operation of double acting cylinder with metering-in control – operation of double acting cylinder with metering-out control – use of shuttle valve in pneumatic circuits – use of quick exhaust valve in pneumatic circuits – automatic operation of double acting cylinder single cycle – multiple cycle – merits and demerits of pneumatic system – applications – Air compressor – types – Reciprocating and screw compressors

UNIT- V

HYDRAULIC SYSTEMS

13 Hrs

Hydraulic system – merits and demerits – service properties of hydraulic fluids hydraulic accumulators – weight of gravity type accumulator – spring loaded type accumulator –

gas filled accumulator – pressure intensifier – fluid power pumps – external and internal gear pump, vane pump, radial piston pump – ISO symbols for hydraulic components – hydraulic actuators – cylinders and motors – valves – pressure control valves, flow control valves and Direction Control Valves (DCV) – types including 4/2 DCV and 4/3 DCV – their location in the circuit.

Hydraulic operation of double acting cylinder with metering-in and metering-out control – application of hydraulic circuits – Hydraulic circuit for – shaping machine – table movement in surface grinding machine and milling machine – comparison of hydraulic and pneumatic systems

Text Books:

- 1) A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines – R. S. Khurmi,- Edn.18, S. Chand & Co., Ram Nagar, New Delhi – 110 055 – 2002
- 2)) Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Pub. Pvt.,Ltd, New Delhi – 110 002

Reference Books:

- 1) Hydraulic Machines – Jagadishlal, Metropolitan Book Co. Pvt. Ltd.,1, Faiz Bazaar, New Delhi – 06.
- 2) Hydraulics – Andrew Parr (A Technician's and Engineer's Guide)
- 3) Fundamentals of Pneumatic Control Engineering – FESTO Manual
- 4) A Text Book of Fluid Mechanics and Hydraulic Machines – R. K Rajput, S. Chand &Co, New Delhi – 55.

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-324 MACHINE DRAWING

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-324 MACHINE DRAWING	Hours / Week	Hours / Sem	Marks			Duration
	6 Hrs	90 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	SECTIONAL VIEWS	03
II	LIMITS, FITS AND TOLERANCES	03
III	SURFACE TEXTURE	03
IV	KEYS, SCREW THREADS AND THREADED FASTENERS	03
V	DRAWING PRACTICE	70

Total Hours	82
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THEORY

UNIT- I SECTIONAL VIEWS

03 Hrs

Review of sectioning – conventions showing the section – symbolic representation of cutting plane- types of section – full section, half section, offset section, revolved section, broken section, removed section – section lining. Convention representation of common machine elements

UNIT- II LIMITS, FITS AND TOLERANCES

03 Hrs

Tolerances – Allowances – unilateral and bilateral tolerances – Limits – Methods of tolerances – indication of tolerances on linear dimension of drawings – geometrical tolerances – application – Fits – classifications of fits – selection of fits – examples

UNIT- III SURFACE TEXTURE

03 Hrs

Surface texture – importance – controlled and uncontrolled surfaces – roughness – waviness – lay – sampling length – machining symbols.

UNIT- IV KEYS, SCREW THREADS AND THREADED FASTENERS

03 Hrs

Types of fasteners – temporary fasteners – keys – classification of keys – heavy-duty keys – light duty keys. Screw thread – nomenclature – different types of thread profiles – threads in sections – threaded fasteners – bolts – nuts – through bolt – tap bolt, stud bolt – set screw – cap screws – machine screws – foundation bolts – Permanent fasteners – applications

UNIT- V DRAWING PRACTICE

70 Hrs

Detailed drawings of following machine parts are given to students to assemble and draw the assembled views with dimensions, bill of materials and with or without sections.

1. Sleeve and Cotter joint
2. Spigot and Cotter joint
3. Knuckle joint
4. Stuffing Box
5. Screw Jack
6. Foot step bearing
7. Universal Coupling
8. Plummer Block
9. Swivel Bearing

10. Simple Eccentric
11. Machine Vice
12. Protected type flanged coupling
13. Connecting Rod
14. Tail Stock

Text Books:

1) Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana

Reference Books:

- 1) A Text book of Engineering Drawing, R.B. Gupta, Satyaprakasan, Technical IndiaPub. New Delhi
- 2) Geometrical and Machine Drawing, N.D. Bhatt, Cheroter book stalls, Anand, West Railway
- 3) Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi

Examination Pattern:

Part - A and Part - B to be answered in the drawing sheet only	
Part - A Theory questions (Answer any 4 out of 5) (4 x 5 marks)	20 Marks
Part - B One assembly drawing (Sectional view - 30, Other view - 20, Bill of material - 5)	55 Marks
Total	75 Marks

Theory	12 Hours
Drawing Practice	70 Hours
Revision / Repetition	08 Hours
Total	90 Hours

R5-325 STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-325 STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL	4 Hrs	60 Hrs	25	75	100	3 Hrs

STRENGTH OF MATERIALS:**Exercises****1. Test on Ductile Materials:**

Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel

2. Hardness Test:

Determination of Rockwell, Brinell & Vickers hardness number for various materials like mild steel, high carbon steel, brass, copper and aluminium

3. Torsion test:

Torsion test on mild steel – relation between torque and angle of twist – determination of shear modulus and shear stress

4. Impact test:

Finding the resistance of materials to impact loads by Izod test and Charpy test

5. Tests on springs of circular section:

Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)

6. Shear test:

Single or double Shear test on MS bar to find the resistance of materials to shear load

FLUID MECHANICS:**Exercises**

1. Verifying the Bernoulli's theorem
2. Determination of co-efficient of discharge of a mouthpiece by variable head method
3. Determination of co-efficient of discharge of an orifice by variable head method
4. Determination of co-efficient of discharge of a venturimeter
5. Determination of co-efficient of discharge of an orificemeter
6. Determination of the friction factor in a pipe
7. Conduct performance test on reciprocating pump and draw the characteristics curves
8. Conduct performance test on centrifugal pump and draw the characteristics curves
9. Study of impulse turbine and reaction turbine

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from strength of materials and one from fluid mechanics practical. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation	Max. Marks
A. STRENGTH OF MATERIALS	35 Marks
Observation	10

Tabulation / calculation	20
Result / Graph	05
B. FLUID MECHANICS	35 Marks
Observation	10
Tabulation / calculation	20
Result / Graph	05
Viva-voce	05 Marks
Total	75 Marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-326 LATHE, DRILLING AND FOUNDRY PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-326 LATHE, DRILLING AND FOUNDRY PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

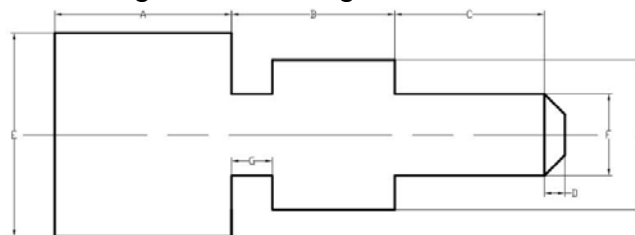
LATHE SECTION:

Introduction of safety in operating machines – Study of lathe and its parts – Types of tools used in lathe work – Study of work holding devices and tool holding devices – Setting of work and tools – Operation of lathe – Practice on a lathe – Types of measuring instruments and their uses.

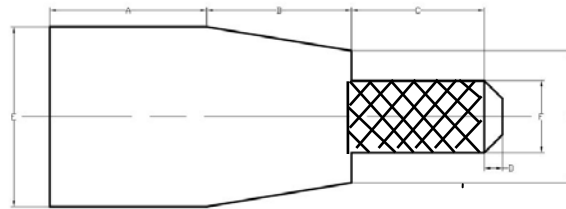
Exercises:

Make the following jobs in the lathe. Raw material 32 mm M.S. Rod

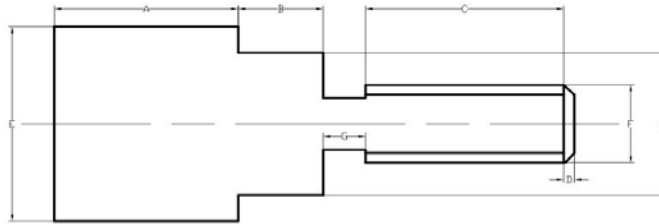
1. Step turning & Groove cutting & Chamfering



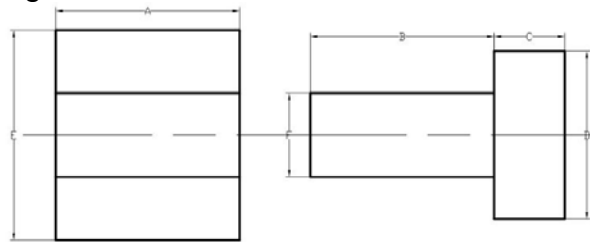
2. Step turning, Taper turning and Knurling



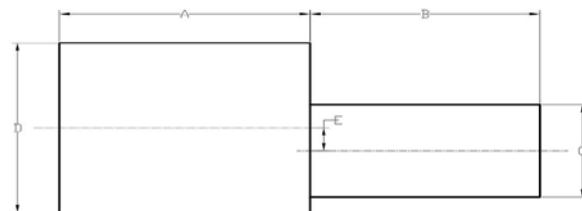
3. Step turning & Thread cutting (R.H)



4. Bush: Turning & Drilling



5. Eccentric Turning



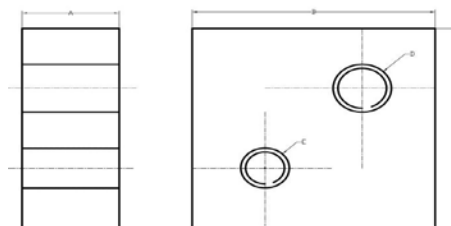
DRILLING SECTION:

Introduction of safety in operating machines – Study of drilling machines and its parts – Study the types of tools used – Study of work holding devices and tool holding devices – Setting of work and tools – Operation and practice – Types of measuring instruments and their uses.

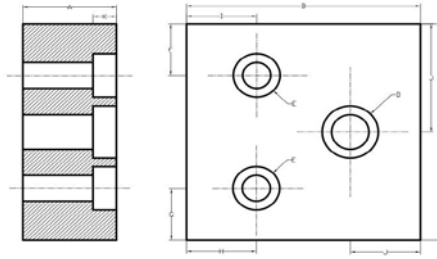
Exercises:

Make the following jobs in the drilling machine. Raw material 50 mm x 50 mm x 20 mm thick M.S. Flat

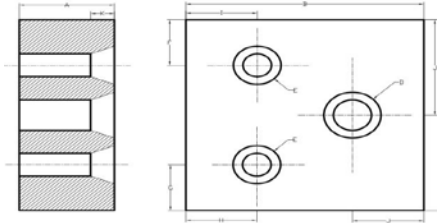
1. Drilling & Tapping



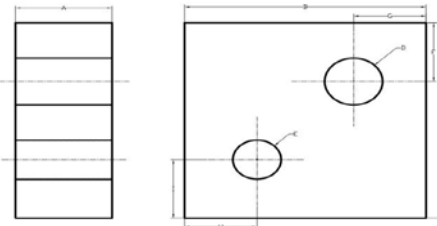
2. Drilling & Counter boring



3. Drilling & Counter sinking



4. Drilling and Reaming – Radial drilling machine



FOUNDRY SECTION:

Introduction of tools and equipment – types of patterns – types of sand – preparation of sand moulds – core sands, preparation of cores

Exercises:

Prepare the green sand mould using the following patterns.

Solid pattern: Stepped pulley – bearing top

Split pattern: Bent Pipe with core making – Yoke – Tumbles

Loose Piece Pattern: Dovetail

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination by selecting one exercise in Lathe (compulsory) and another one exercise from Drilling or Foundry. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
Lathe		45 marks (2hours)
1	Procedure / Preparation	10
2	Machining / Dimensions	25
3	Surface Finishing	10
Drilling		25 marks (1 hour)
1	Procedure / Marking	10
2	Dimensions	10

3	Surface Finishing	05
Foundry		25 marks (1 hour)
1	Preparation of sand	10
2	Ramming and vent holes	10
3	Gate cutting / Finishing	05
Viva-voce		05 marks
Total		75 marks

Theory & practical exercises	54 Hours
Revision / Repetition	06 Hours
Total	60 Hours

R5-327 COMPUTER APPLICATIONS PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-327 COMPUTER APPLICATIONS PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

SECTION – A

GRAPHICAL OPEARTING SYSTEM

Introduction to GUI OS; Features and various versions of GUI OS & its use; Working with GUI OS; My Computer & Recycle bin; Desktop, Icons and Explorer; Screen description & working styles of GUI OS; Dialog Boxes & Toolbars; Working with Files & Folders; simple operations like copy, delete, moving of files and folders from one drive to another, Shortcuts & Auto start; Accessories and Windows Settings using Control Panel - setting common devices using control panel, modem, printers, audio, network, fonts, creating users, internet settings, Start button & Program lists;

Exercises

1.
 - a. Installing screen saver and change the monitor resolution by 1280 x 960
 - b. Setting wall papers
 - c. Creating, moving, deleting and renaming a folder
 - d. Copy, paste and cut a folder/file
 - e. Displaying the properties for a file or folder
2.
 - a. Restoring files and folders from Recycle bin
 - b. Creating short cuts for folder/file
 - c. Finding a file or folder by name
 - d. Selecting and moving two or more files/folders using mouse
 - e. Sorting folders / files

WORD PROCESSING

Introduction to Word Processing – Examples – Creation of new documents, opening the existing document, insert a document into another document. Page setup, margins, gutters, font properties, alignment, page breaks, header and footer, deleting, moving, replacing and editing text in document. Saving a document, spell checker

Printing a document – Creating a table – entering and editing text in tables – Changing format of table – height/width of row or column – Editing & deleting rows / columns in table – Creating columns, applying borders, watermark, shading, templates, wizards, drawing objects, Mail merge.

Exercises

3. Create the following table and perform the operations given below

- Arrange the cell alignment for the complete table as center, center (both horizontally and vertically)
- Fill the days column and hours row with 15% gray color
- Implement merging and splitting two or more cells wherever necessary
- Apply alternative foreground colors for columns

DAYS	1	2	3	4	5	6	7	8
MON	← TEST →		A: JPP			CA	RDBMS	TUT
			B: RDBMS					
TUE	CA	OOP	CN	RDBMS	A: RDBMS			
					B: JPP			
WED	CN	RDBMS	OOP	RDBMS	COMMUNICATION		CN	CA
THU	OOP	A: JPP			CA	RDBMS	CN	OOP
		B: RDBMS						
FRI	COMMUNICATION		A: RDBMS		OOP	CN	RDBMS	CA
			B: JPP					
SAT	OOPS	RDBMS	N	CA	-----			

4. Create a standard covering letter and use mail merge to generate the customized letters for applying to a job in various organizations. Also, create a database and generate labels for the applying organizations.
5. Create a news letter of three pages with two columns text. The first page contains some formatting bullets and numbers. Set the document background color and add Confidential' as the watermark. Give the document a title which should be displayed in the header. The header/ footer of the first page should be different from other two pages. Also, add author name and date/ time in the header. The footer should have the page number.

SPREADSHEET

Introduction to Analysis Package – Examples – Concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Different Views of Worksheets; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook & Worksheets with various options.

Exercises

6. Create a result sheet containing Candidate's Register No., Name, and Marks for six subjects. Calculate the total and result. The result must be calculated as below and failed candidates should be turned to red.

Result is Distinction if Total $\geq 70\%$

First Class if Total $\geq 60\%$ and $< 70\%$

Second Class if Total $\geq 50\%$ and $< 60\%$

Pass if Total $\geq 35\%$ and $< 50\%$ Fail otherwise

Create a separate table based on class by using auto filter feature.

7. Create a table of records with columns as Name and Donation Amount. Donation amount should be formatted with two decimal places. There should be at least twenty records in the table. Create a conditional format to highlight the highest donation with blue color and lowest donation with red color. The table should have a heading.

8. Create line chart, bar chart and pie charts to highlight the sales of the company for three different periods for the following data.

SALES BAR CHART

Period	Product 1	Product 2	Product 3	Total
JAN	35	40	50	125
FEB	46	56	40	142
MAR	70	50	40	160

SECTION – B

DATABASE

Introduction – Menus – Tool bar – Create – Edit – Save – Data types – Insert – Delete – Update – View – Sorting and filtering – Queries – Report – Page setup – Print.

Exercises

9. Create Database to maintain at least 10 addresses of your class mates with the following constraints

- Roll no. should be the primary key.
- Name should be not null

10. Create a student's table with the following fields: Sr. No., Reg. No, Name, Marks in 5 subjects. Calculate total and percentage of 10 students. Perform the following queries.

- To find the details of distinction student
- To find the details of first class students
- To find the details of second class students

11. Design a report for the above exercise to print the consolidated result sheet and mark card for the student.

PRESENTATION

Introduction – Opening new presentation, Parts of PowerPoint Window – Opening – Saving and closing presentations – Features of PowerPoint, Background design, Word art, Clip art, Drawings, 3D settings – Animations, Sound, Views and types of views – Inserting and deleting slides, arranging slides, slides show, rehearsal, setup show, custom show – Creating custom presentations, action setting, auto content wizard, working with auto content wizard.

Exercises

12. Make a marketing presentation of any consumer product with at least 10 slides.
Use different customized animation effects on pictures and clip art on any four of the ten slides.
13. Create a Presentation about our institution / any subject with different slide transition & sound effect.

INTERNET

Introduction – Getting acquainted with Internet Connection – Browsers – Website URL – Open a website – Net Browsing – Email: Creating E-mail id – Sending, receiving and deleting E-mail – Email with Attachments – CC and BCC – Chatting – Creating Group mail – Google docs – Search Engines – Searching topics.

Most Popular Social Networking Sites: History – Features – Services – Usage of Face book, Twitter and LinkedIn. Transferring data through Wi-Fi or Bluetooth among different devices – Introduction to cybercrime – Software Piracy – Viruses – Antivirus Software

Exercises

14. Create an e-mail id and perform the following
 - Write an e-mail inviting your friends to your Birthday Party.
 - Make your own signature and add it to the e-mail message.
 - Add a word attachment of the venue route
 - Send the e-mail to at least 5 of your friends.
15. Create a presentation on Google docs. Ask your friend to review it and comment on it. Use “Discussion” option for your discussions on the presentation.

Software Requirement:

1. Any GUI Operating System
2. Open Source Software / MS - Office

Reference Books:

1. MS OFFICE – Dr. S.S. Srivastava, Laxmi Publications Pvt. Ltd.
2. 2007 MS Office System Plain & Simple – Joyce & Moon, PHI Learning
3. MS Office Home and Student 2007 step by step – Preppernan, Cox & Frye, PHI Learning

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from section – A and one from section – B. The students are

allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation	Max. Marks
Writing Procedure – One Question from Section A	15
Demonstration	15
Results	05
Writing Procedure – One Question from Section B	15
Demonstration	15
Results	05
Viva-voce	05
Total	75 Marks

Theory & Practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

FOURTH SEMESTER R5-421 HEAT POWER ENGINEERING

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-421 HEAT POWER ENGINEERING	Hours / Week	Hours / Sem	Marks			Duration
	6 Hrs	90 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES	16
II	THERMODYNAMIC AIR CYCLES, PERFORMANCE OF IC ENGINES AND HEAT TRANSFER	16
III	AIR COMPRESSORS AND GAS TURBINES	16
IV	FUNDAMENTALS OF ENERGY, SOLAR ENERGY AND WIND ENERGY	16
V	BIO-ENERGY, OCEAN AND GEOTHERMAL ENERGY	16
Total Instruction Hours		80

UNIT - I BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES 16 Hrs

Introduction – definitions and units of mass, weight, volume, density, specific weight, specific gravity and specific volume – pressure – units of pressure – temperature – absolute temperature – S.T.P and N.T.P conditions – heat – specific heat capacity at constant volume and at constant pressure – work – power – energy – types – law of conservation of energy – thermodynamic system – types – thermodynamic equilibrium – properties of systems – intensive and extensive properties – state of system – process – cycle – point and path functions – zeroth, first and second laws of thermodynamics – simple problems

Perfect gases – laws of perfect gases – Boyle's, Charles, Joule's, Regnault's and Avogadro's laws – general gas equation – characteristic gas equation – relation between specific heats and gas constant – universal gas constant – problems – thermodynamic processes – change in internal energy – enthalpy – change in enthalpy – entropy – change in entropy – general equations for change in entropy

Constant volume, constant pressure, isothermal (hyperbolic), isentropic (reversible adiabatic), polytropic – p-V and T-s diagrams, work done, change in internal energy, heat transfer, change in enthalpy, change in entropy for various processes – problems – free expansion and throttling processes

UNIT - II

THERMODYNAMIC AIR CYCLES, PERFORMANCE OF IC ENGINES AND HEAT TRANSFER

16 Hrs

Air cycles – air standard efficiency – reversible and irreversible processes – assumptions in deriving air standard efficiency – Carnot cycle – Otto cycle – Joule cycle – Diesel cycle – comparison of Otto cycle and Diesel cycle – comparison of ideal and actual p-V diagrams of Otto and Diesel cycles – problems – dual combustion cycle (description only) – testing – thermodynamic and commercial tests – indicated power – brake power – friction power – efficiencies of I.C. engines – indicated thermal, brake thermal, mechanical and relative efficiencies – Specific fuel consumption – problems – Morse test – procedure – problems – heat balance sheet – simple problems

Modes of heat transfer – heat transfer by conduction – Fourier's law – thermal conductivity – heat conduction through plane and composite walls – heat conduction through a cylinder – simple problems – heat transfer by convection – heat exchanger – parallel flow and counter flow – LMTD – forced convection – natural convection – heat transfer by radiation – Radioactive properties definitions of black and white and opaque, transparent & grey bodies

UNIT - III

AIR COMPRESSORS AND GAS TURBINES

16 Hrs

Air Compressors – uses of compressed air – classifications of air compressor – reciprocating compressor – single stage reciprocating compressor – compression processes – power required to drive the compressor (neglecting clearance volume) – problems – clearance volume and its effects – volumetric efficiency – power required to drive the compressor with clearance volume – problems – multi stage compression – merits and demerits – two stage compressor – with perfect inter cooling – work input – condition for minimum work input in multi stage compressor with perfect inter cooling – simple problems (perfect cooling) – rotary compressors – Roots blower – Vane blowers – centrifugal and axial flow air compressors.

Gas turbines – uses – classifications – merits and demerits of gas turbines – constant pressure combustion gas turbine – gas turbine with intercooler – reheater – regenerator – effects – closed cycle gas turbines – merits and demerits of open and closed cycle gas turbines – jet propulsion – turbojet engines – merits and demerits – turbo propeller

engines – merits and demerits – ramjet – merits and demerits – rocket engines – applications of rockets

UNIT - IV

FUNDAMENTALS OF ENERGY, SOLAR ENERGY AND WIND ENERGY

16 Hrs

Energy scenario in India – overall production and consumption – availability of primary energy resources: conventional, non-conventional – estimated potential and achievement – growth of energy sector and its planning in India – energy conservation – meaning and importance

Solar energy – Introduction – solar radiation at the earth's surface – solar radiation measurements – classifications – flat plate collectors – concentrating collectors – comparison – solar water heaters – solar industrial heating system – solar refrigeration and air-conditioning systems – solar cookers – solar furnaces – solar green house – solar distillation – solar pond electric power plant – distributed collector – solar thermal electric power plant – principles of photovoltaic conversion of solar energy – types of solar cells – solar photo voltaic applications

Wind energy – basic principles of wind energy conversion: site selection – classification of wind energy conversion systems – advantages and disadvantages – types of wind machines – horizontal axis machine – vertical axis machine – generating system – energy storage – application of wind energy – safety and environmental aspects

UNIT - V

BIO-ENERGY, OCEAN AND GEOTHERMAL ENERGY

16 Hrs

Bio-Energy – Introduction – photo synthesis – usable forms of Biomass, their composition and fuel properties – Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – Biomass liquidification – Biomass to ethanol production – Biogas production from waste Biomass – types of Bio gas plants - applications – Bio diesel production – Biomass energy programmes in India

Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – components and operations of tidal power plant – energy and power forms of waves – wave energy conversion devices

Geothermal Energy – Geothermal sources – prime movers for Geothermal energy conversion (Concepts only) – advantages and disadvantages – applications – material selection for Geothermal power plants – Geothermal exploration – operational and environmental problems – prospects of Geothermal energy in India – Introduction to power auditing

Text Books:

- 1) Thermal Engg, R.K .Rajput , ,8th Edition, Laxmi publications Pvt Ltd , New Delhi.
- 2) Applied Thermodynamics ,P.K. Nag, ,2nd Edition, TATA Mcgraw– Hill Publishing Company, New Delhi .
- 3) Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, S.Chand & Co, NewDelhi
- 4) Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.

Reference Books:

- 1) Thermal Engineering ,P.LBallaney , 24th Edition ,Khanna Publishers,New Delhi.
- 2) Thermal Engineering ,B.K. Sarkar , 3rd Edition , Dhanpat Rai & SonsNew Delhi .
- 3) Applied Thermodynamics, Domkundwar & CPKothandaraman, 2 Edition, Khanna publishers, New Delhi.
- 4) Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.
- 5) Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.
- 6) "Non-Conventional Energy Resources - B.H.Khan - Tata McGraw Hill, 2nd Edn, 2009.

Instruction Hours	80 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	90 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-422 SPECIAL MACHINES

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-422 SPECIAL MACHINES	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	MANUFACTURING OF PLASTIC COMPONENTS AND COMPOSITE MANUFACTURING	13
II	RECIPROCATING MACHINES AND BROACHING MACHINE	13
III	MILLING MACHINES AND GEAR GENERATING PROCESSES	13
IV	ABRASIVE PROCESS AND NON-CONVENTIONAL MACHINING PROCESSES	13
V	CNC MACHINE AND ITS COMPONENTS	13
Total Instruction Hours		65

UNIT - I**MANUFACTURING OF PLASTIC COMPONENTS****13 Hrs**

Plastic Components: Types of plastics – engineering plastics – thermosets – composite – structural foam, elastomers – polymer alloys and liquid crystal polymers – factors influencing the selection of plastics – mechanical properties – degradation – wear resistance – frictional properties – special properties – processing – cost

Processing of Plastics: Extrusion – general features of single screw extrusion – Twin screw extruders – Injection moulding types – Plunger type – Reciprocating screw injection – details of injection mould – structural foam injection mould – Sandwich moulding – Gas injection moulding – Injection moulding of thermosetting materials – Calendaring and rotational moulding – design consideration for plastic components

Composite manufacturing: Introduction – characteristics of composite manufacturing – constituents – glass fibers manufacturing process – hand laminating process – autoclave processing – filament winding – pultrusion process – liquid composite process – working principles by schematic diagram only – advantages – disadvantages

UNIT - II**RECIPROCATING MACHINES****13 Hrs**

Planer: Introduction –Types of planer (construction and working principle) – Double housing planer – Open side planer – Pit planer – Edge planer – Divided table planer – specifications – principles of operation – drives – quick return mechanism – open and cross belt – electric drive – hydraulic drive – feed mechanism – work holding devices and special fixtures – types of tools – operations

Shaper: Introduction – specifications – principles of operations – types of shaper- Standard shaper – Universal and Draw cut shaper – Quick return mechanism – Crank and slotted link – hydraulic shaper – feed mechanism – work holding devices – fixture – operations

Slotter: Introduction – specifications – method of operation – Whitworth quick return mechanism – Feed mechanism – work holding devices – types of tools

Broaching: Types of broaching machine – horizontal, vertical and continuous broaching – principles of operation – types of broaches – classification – broach tool nomenclature – broaching operations

UNIT - III

MILLING MACHINES AND GEAR GENERATING PROCESSES

13 Hrs

Milling Machines: types – Column and knee type – Plain – Universal and Omniversal milling machine – Vertical milling machine – Plano miller – principles of operation – specification of milling machines – work holding devices – tool holding devices – Arbor – Stub arbor – Spring collet – Adapter – Milling cutters: Cylindrical milling cutter – Slitting cutter – Side milling cutter – Angle milling cutter – T-slot milling cutter – Woodruff milling cutter – Fly cutter – nomenclature of cylindrical milling cutter – Milling operations: Straddle milling – Gang milling – Vertical milling attachment – Indexing head (Plain and universal dividing head) – Indexing plate – Differential indexing – Simple indexing – Compound indexing – simple problems

Generating Process: Gear shaper – Gear hobbing – Gear planning – Bevel gear generator – principle of operation only – Gear finishing processes: burnishing – Shaving – Grinding and Lapping – gear materials

UNIT - IV

ABRASIVE PROCESS AND NON-CONVENTIONAL MACHINING PROCESSES

13 Hrs

Abrasive Process: Types and classification – Grinding machines – specifications – rough grinding – Pedestal grinders – Portable grinders – Belt grinders – precision grinding – Cylindrical grinder – Centerless grinders – Surface grinder – Tool and cutter grinder – Planetary grinders – principles of operations – Grinding wheels – Abrasives – Natural and Artificial diamond wheels – types of bonds – Grit, Grade and Structure of wheels – wheel shapes and sizes – standard marking systems of grinding wheels – selection of grinding wheel – mounting of grinding wheels – Glazing and loading of grinding wheel – Dressing and Truing of grinding wheels – balancing of grinding wheels

Non-Conventional Machining Processes: Construction, working and applications of Ultrasonic machining – Chemical machining – Electro-chemical grinding – Electrical discharge machining – Plasma arc machining – Laser beam machining – advantages – disadvantages

UNIT - V

CNC MACHINE AND ITS COMPONENTS

13 Hrs

CNC Machines: Numerical control – definition – working principle of a CNC system – Features of CNC machines – advantage of CNC machines – difference between NC and CNC – Construction and working principle of turning centre – Construction and working principle of machining centre – Machine axes conventions turning centre and Machining centre – Coordinate Measuring Machine – construction and working principle

Components of CNC machine: slide ways – requirement – types – friction slide ways and antifriction slide ways – linear motion bearings – Recirculation ball screw – ATC – Tool magazine – feedback devices – Linear and Rotary transducers – Encoders – in-process probing – tool material – Tool inserts – Five axis HMC – Turn mill centre – applications

Text Books:

1. Elements of Workshop Technology – Vol. I & II, Hajra Choudry & Battacharya, Edn. 11, Media Promoters and Publishers Pvt. Ltd., Mumbai 400 007 – 2007
2. Production Technology – Jain & Gupta, Khanna Publishers, New Delhi – 110 006 – 2006

Reference Books:

1. Production Technology – HMT, Edn. 18, Tata McGraw Hill Publishing Co. Ltd., New Delhi 110 008
2. Manufacturing Process – Myro N Begman, Edn. 5, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi 110 008
3. Workshop Technology – Vol I,II, III, WAJ. Chapman, Viva Books Pvt. Ltd., New Delhi 110 002
4. Production Processes – NITTTR, Tata McGraw Hill Publishing Co. Ltd, New Delhi 110 008.
5. Principles of the Manufacturing of Composite Materials – Suong V Hoa, DES tech publication. Inc, Lancaster, Pennsylvania – 17602 U.S.A.

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-423 ELECTRICAL DRIVES AND CONTROL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-423 ELECTRICAL DRIVES AND CONTROL	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	DC CIRCUITS AND DC MACHINES	13
II	AC CIRCUITS AND AC MACHINES	13
III	STEPPER AND SERVO MOTORS & DRIVES	13
IV	POWER SUPPLIES AND LOGIC GATES	13
V	CONTROL ELEMENTS AND PLC	13
Total Instruction Hours		65

UNIT - I**DC CIRCUITS AND DC MACHINES****13 Hrs**

Definition – electric current, voltage and resistance – Ohm's law and Kirchhoff's law – resistance in series and parallel and series, parallel – simple problem – selector magnetism (definitions only) – magnetic flux, flux density, magnetic field intensity, MMF, permeability, reluctance – Faraday's law of electromagnetic induction, electrical and mechanical units – DC generators – construction, principle of operation, types and applications

DC motors: construction, principle of operation, types and application – necessity of starters – three point starters – four point starters

UNIT - II

AC CIRCUITS AND AC MACHINES

13 Hrs

Fundamentals of AC voltage, and current – peak, average, RMS value of sine wave, frequency, time period, amplitude, power and power factor (definition only) – star and delta connection relationship between phase, line voltage and current in star and delta connections – Power capacitors – reactors (Introduction only)

Transformer: Principle of operation and construction – EMF equation (no definition) – losses in transformer – efficiency – application. Alternator construction – principle of operation – types and applications

AC machine: AC motors – principle of operation of single phase capacitor start induction motor – universal motor – applications – three phase induction motors – squirrel cage and slip ring Induction motors (construction and working principle only) – application – speed control of 3 phase induction motor – necessity of starters – DOL and star/delta transformer

UNIT - III

STEPPER AND SERVO MOTORS & DRIVES

13 Hrs

PMDC, stepper motor – construction and working principle and applications – servomotor – types: brushless servomotor, permanent magnet servo motor construction and applications

Industrial drives – types, group drive, individual drive, multi motor drive, block diagram of variable frequency drive, stepper motor drive: single stepping and half stepping – servo drives – electrical safety: importance of earthing – electric shock: first aid, precautions – causes of accident and their preventive measures – energy conservation

UNIT - IV

POWER SUPPLIES AND LOGIC GATES

13 Hrs

Diode – terminals: anode and cathode, forward biasing and reverse biasing – use of diode in rectifiers – half wave and full wave – necessity of filters – regulated power supplies: IC voltage regulators – SMPS, UPS and inverters – general description and their applications display devices – LED, 7 segment LED, LCD Logic gates: positive and negative logic, definition, symbol truth table, boolean expression for OR, AND, NOT, NOR, NAND, EXOR AND EXNOR gates – universal logic Gates: NAND and NOR.

UNIT - V

CONTROL ELEMENTS AND PLC

13 Hrs

Fuses – selection of fuse – necessity of fuse – fuse switch units. Sensors: Photo electric sensor, inductive proximity sensors, temperature sensors. Switches: Push button switch, selector switch, limit switch, pressure switch, temperature switch, float switch and reed switch. Relays – NO, NC – usage – bimetallic thermal overload relays. Contactors – usage – necessity of contactor – Solenoid type contactor circuit breakers – Moulded Case Circuit Breaker (MCCB) and Miniature Circuit Breaker (MCB), Oil Circuit Breakers (OCB), Earth Leakage Circuit Breaker (ELCB) – features of PLC – PLC block diagram – PLC scan – fixed and modular PLC ladder logic – NO, NC contacts – coils – AND and OR

Text Books:

- 1) "A Course in Electrical Engineering " - B.L. Theraja - Multi Colour Edition, S Chand & Co, Reprint 2006
- 2) Control of Machines - S.K Bhattacharya, Brijinder Singh – New Age Publishers, 2nd Edition- 2010
- 3) "Electronic Circuits & System- Analog and Digital" – Y.N. Bapat -Tata McGraw Hill .

Reference Books:

- 1) "Electrical Devices and Circuits" – Jacob Millman & Halkies, - Tata McGraw Hill, New Delhi.
- 2) "Modern Digital Electronics" – R P Jain, 2003, Tata McGraw Hill, New Delhi.

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-424 COMPUTER AIDED MACHINE DRAWING PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-424 COMPUTER AIDED MACHINE DRAWING PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	6 Hrs	90 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

I INTRODUCTION TO CAD SOFTWARE

05 Hrs

Introduction – History of CAD – Applications – advantages over manual drafting– hardware requirements – software requirements – Windows desktop – CAD screen interface – menus – tool bars – how to start CAD – how to execute command – types of co-ordinate systems – Absolute – Relative – Polar

II DRAWING AIDS AND EDITING COMMANDS

05 Hrs

Creating objects (2D) – using draw commands – Line, Arc, Circle, Ellipse, Donut, Polygon, Point, Pline, Sketch, Trace – creating 2D solid. Creating text – Dtext, Mtext, Text styles – Mline, spline – drawing with precision – Osnap options – drafting settings – limits – Units – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys - Editing and modify commands – object selection methods – erasing object – Oops – cancelling and undoing a command – Copy – Move – Array – Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode – Divide – Measure – stretch – Lengthen – Changing properties – Color – line types – LT scale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit

III BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS

05 Hrs

Basic dimensioning – editing dimensions – dimension styles – dimension system variables – machine drawing with CAD – creation of blocks – Wblock – inserting a block – Block attributes – Hatching – pattern types – Boundary hatch – working with layers – Controlling the drawing display – Blip mode – view group commands – zoom, redraw, regen, regenauto, pan, viewers – real time zoom – inquiry groups – calculating area – distance – time – status of drawing – using calculator

IV ISOMETRIC DRAWING, PRINTING AND PLOTTING**05 Hrs**

Isometric drawing – Isometric projection – drawing isocircles – Dimensioning isometric objects – File commands – File Import and export – plotting drawing – external references – 3D fundamentals – 2D to 3D Conversion 3D Drawing: 3D Primitives – Extrude – Revolve – Slice – Section, Surface 3D Mesh – 3D – Surface – 3D Operation – Solid Editing

V CAD DRAWING PRACTICE**60 Hrs**

Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations / plans / and side views with dimensioning and bill of materials using CAD Software

EXERCISES (2D Drawing)

1. Sleeve and cotter joint
2. Spigot and cotter joint
3. Knuckle joint
4. Stuffing box
5. Screw jack
6. Foot step bearing
7. Universal coupling
8. Plummer block
9. Simple eccentric
10. Machine vice
11. Connecting rod
12. Protected type flanged coupling

Text Books:

- 1) Inside AutoCAD - D. Raker and H. Rice - BPB Publications, New Delhi
- 2) Engineering Drawing and Graphics + AutoCAD – K.Venugopal, - New Age Int. Pub.

Reference Books:

- 1) CAD/CAM/CIM - P. Radhakrishnan, S. Subramaniam and V.Raju - New Age Int. Pub.
- 2) AutoCAD 2002 with Applications - Sham Tickoo - Tata Mc graw Hill.
- 3) Computer Graphics, Prentice – Donald Hearn, M. Pauline Baker - Hall of India Pvt. Limited, New Delhi.

Examination Pattern:

Note: All the exercises have to be completed. One Assembled drawing will be given for examination. The students are allowed to select the questions by lot. In written exam eight 3 mark questions will be asked, out of which 5 questions to be answered. Record notebook should be submitted during the practical examination.

Internal Assessment		External Assessment	
Skill	5	Written Exam (0.30 Hour)	15
Execution of drawings	5	CAD Practical (2.30 Hours) Assembled drawing	55
Regular class drawing practice	15	Viva-vice	5
Total	25	Total	75

Theory & practical exercises	80 Hours
Revision / Repetition	10 Hours
Total	90 Hours

R5-425 METROLOGY AND METALLOGRAPHY PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-425 METROLOGY AND METALLOGRAPHY PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

PART – A: METROLOGY & MEASUREMENT

Exercises:

I. Linear Measurements:

1. Determine the thickness of ground MS flat / diameter and length of cylindrical objects / inside diameter of a bush component to an accuracy of 0.02 mm using vernier caliper
2. Determine the diameter of a cylindrical component to an accuracy of 0.01 mm using micrometer and check the result with digital micrometer
3. Determine the thickness of ground MS plates using slip gauges

II. Angular Measurements:

1. Determine the angle of V - block, Taper shank of drill and dovetails in mechanical components using universal bevel protractor.
2. Determine the angle of machined surfaces of components using sine bar with slip gauges.

III. Geometric Measurements:

1. Measure the geometrical dimensions of V - Thread
2. Measure the geometrical dimensions of spur gear

PART – B: METALLOGRAPHY

Exercises:

1. Using the metallurgical microscope identify the grain structure of a given specimen.

2. Preparation of specimen to examine the microstructure of (i) Ferrous and (ii) Non-ferrous metals (minimum two exercises on each category).
3. Detection of cracks in casting using visual inspection and ring test
4. Detection of cracks in casting using die penetration test
5. Detection of cracks in casting using magnetic particle test.

Examination Pattern:

Note: All the exercises in each section have to be completed. Two experiments will be given for examination, one from Metrology & Measurement and one from Metallography practical. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
Metrology & Measurement		45 marks (2hours)
1	Procedure / Least Count	15
2	Reading / Calculation	20
3	Result	10
Metallography		25 marks (1 hour)
1	Procedure	10
2	Preparation and observation	10
3	Result	05
Viva-voce		05 marks
Total		75 marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

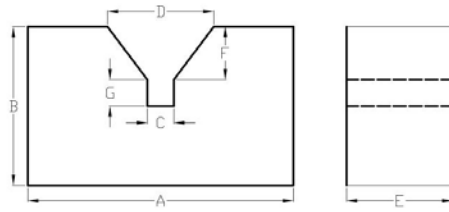
R5-426 SPECIAL MACHINES PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-426 SPECIAL MACHINES PRACTICAL	4 Hrs	60 Hrs	25	75	100	3 Hrs

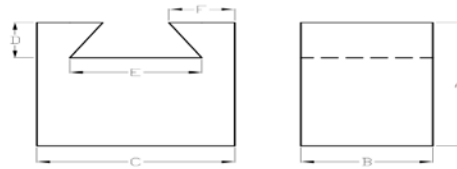
Exercises:

Raw Material: MS / CI

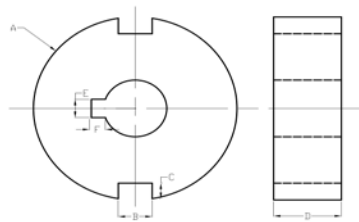
1 Make 'V' Block using shaping machine



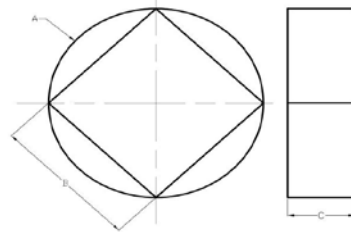
2. Make dovetail using shaping machine



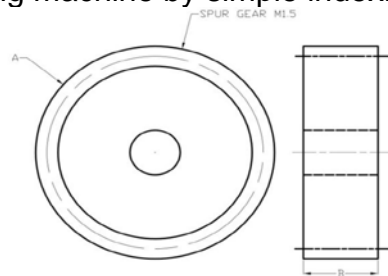
3. Make groove cut using slotting machine



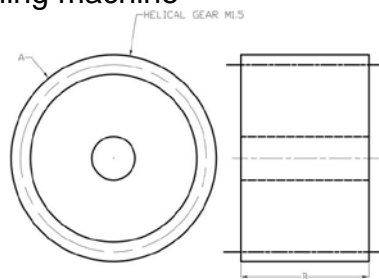
4. Make round to square in milling machine.



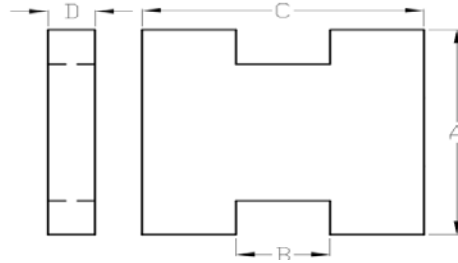
5. Make Spur Gear using milling machine by simple indexing.



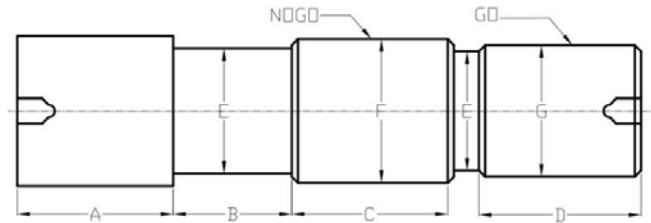
6. Make Helical Gear using milling machine



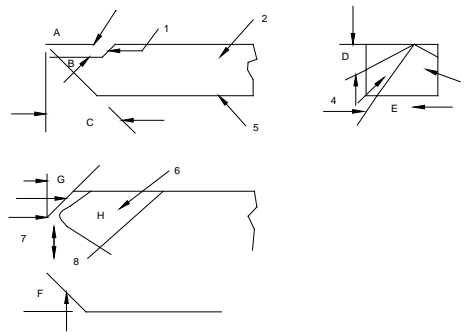
7. Make slot cut using milling machine.



8. Make a Progressive type Plug gauge using Cylindrical Grinding machine

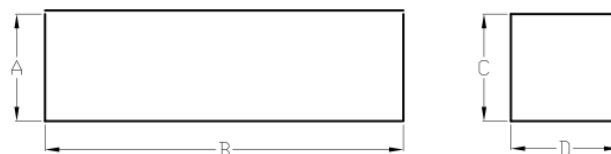


9. Make a Turning Tool using Tool and Cutter Grinder



A - Top rake angle	1 & 6 - Face
B - Lip angle	2 - Shank
C - Front clearance angle	3 - Side flank
D - Side rake angle	4 - End flank
E - End clearance angle	5 - Base
F - Side cutting edge angle	6 - End cutting edge
G - End cutting edge angle	7 - Nose
H - Nose angle	8 - Side cutting edge
	9 - Nose radius

10. Make plain surfaces (four surfaces) using Surface Grinder



11. Drilling Exercise in DRO Vertical Turning Machine

Examination Pattern:

Note: All the exercises have to be completed. Any one experiment will be given for examination. The students are allowed to select the question by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
1	Job preparation / Marking	15 Marks
2	Setting / Operations	30 Marks
3	Dimensions / Surface Finish	25 Marks
4	Viva voce	05 Marks
Total		75 Marks

Practical Exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-427 ELECTRICAL DRIVES AND CONTROL PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-427 ELECTRICAL DRIVES AND CONTROL PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

LIST OF EXPERIMENTS:**PART - A**

1. Verification of Ohm's Law
2. Testing of DC starters - 3 point and 4 point starter
3. Load test on DC shunt Generator
4. Load test on transformer
5. Testing of AC starters- DOL, Star-Delta starter
6. Load test on single phase induction motor
7. Load test on three phase squirrel cage motor
8. Testing of relays, contactors, push buttons and limit switch
9. ON & OFF- Delay timer to control a motor

PART - B

1. Construction and testing of half wave and full wave rectifier.
2. Construction and testing of IC voltage regulator using IC 7805.
3. Operation of a motor using AND & OR logic control
4. Verification of truth tables for logic gates.
5. Verification of universal gates.
6. Identification and testing of display devices - LED, 7 segment LED, Laser diode.
7. Construction and testing of Stepper motor drive.
8. Construction and testing of Servo motor drive.

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Part – A and one from Part – B. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Detailed Allocation		Max. Marks
Exercise 1 (PART – A)		35 Marks
1	Circuit diagram	05
2	Connections & Readings	15
3	Calculations & Graph	15
Exercise 2 (PART – B)		35 Marks
1	Circuit diagram	05
2	Connections & Readings	15
3	Calculations & Graph	15
Viva-voce		05 Marks
Total		75 Marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

FIFTH SEMESTER
R5-521 THERMAL POWER ENGINEERING

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-521 THERMAL POWER ENGINEERING	6 Hrs	90 Hrs	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	FORMATION AND PROPERTIES OF STEAM & THERMODYNAMIC PROCESSES OF VAPOUR	16
II	STEAM BOILERS AND PERFORMANCE OF BOILERS	16
III	THERMAL POWER PLANT AND STEAM TURBINES AND CONDENSERS	16
IV	REFRIGERATION AND AIR CONDITIONING	16
V	NUCLEAR POWER PLANT AND ENERGY AUDIT - ENERGY CONSERVATION	16
Total Instruction Hours		80

UNIT - I
FORMATION AND PROPERTIES OF STEAM & THERMODYNAMIC PROCESSES OF VAPOUR
16 Hrs

Steam – properties – formation of steam – saturation temperature – enthalpy of water – enthalpy of evaporation – conditions of steam – wet, dry and superheated steam – dryness fraction – enthalpy of wet, dry and super heated steam – advantages of superheated steam – property diagrams – p-v diagram – T-H diagram – T-V diagram – T-S diagram – phase diagram – H-S diagram – P-H diagram – critical conditions of water – specific volume of water and steam – density of steam – external work done during evaporation – internal latent heat – internal energy of steam – entropy of water and steam – steam tables – Mollier chart – problems

Determination of dryness fraction of steam – bucket calorimeter – combined separating and throttling calorimeters – problems. Expansion processes of steam – constant volume, constant pressure, and constant temperature, hyperbolic, polytropic, isentropic and throttling processes – problems

UNIT - II

STEAM BOILERS AND PERFORMANCE OF BOILERS

16 Hrs

Introduction – classification of boilers – comparison of fire tube and water tube boilers – high pressure boilers – advantages of high pressure boilers – Lamont, Velox, Benson and BHEL high pressure boilers – boiler mountings and function – construction and working – boiler accessories and function – construction and working – comparison of mountings and accessories – feed water treatment – internal and external treatments – starting boiler from cold condition – safety precautions in boiler operation – clauses of Indian Boiler Act. Evaporation rate – actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler efficiency – boiler power – problems – boiler plant – efficiency of economizer and super heater – problems

UNIT - III

THERMAL POWER PLANT AND STEAM TURBINES AND CONDENSERS

16 Hrs

Selection of site for thermal power plant – layout of thermal power plant – fuel and ash circuit – water and steam circuit – air and flue gas circuit – cooling water circuit – merits and demerits of thermal power plant – air pollution by thermal power plants – pollutants, effects and control – cyclone separator – wet scrubber – electrostatic precipitator – control of NO₂ and SO₂ fluidized bed combustion – thermal and noise pollution

Basic steam power cycles – Carnot, Rankin and modified Rankin cycles – classification of steam turbine – impulse and reaction turbines – difference – necessity of compounding – methods of compounding – special turbines

Steam condensers – elements of condensing plant – classification of condensers – jet condenser – types – surface condensers – types – comparison of jet and surface condensers – sources of air in condenser – condenser vacuum – vacuum efficiency – condenser efficiency – Dalton's Law – mass of cooling water required – mass of air present – number of tubes – problems – cooling towers

UNIT - IV

REFRIGERATION AND AIR CONDITIONING

16 Hrs

Refrigeration – refrigerators and heat pumps – types and applications of refrigeration systems – refrigerating effect – unit of refrigeration – C.O.P – actual C.O.P – air refrigeration system – reversed Carnot cycle – C.O.P of refrigerator, heat pump & heat Engines – power required – mass of ice produced – problems – Bell-Coleman cycle – problems – Innovative vapour compression system – cascade refrigeration system – multi stage compression system – multipurpose with single compressor system – vapour

compression system – vapour absorption system – comparison – refrigerants – desirable properties

Air conditioning – classification and applications of air conditioning system – room air conditioning – central air conditioning – comparison – comfort and industrial air conditioning – factors to be considered in air conditioning – loads encountered in air conditioning systems

UNIT - V

16 Hrs

NUCLEAR POWER PLANT AND ENERGY AUDIT - ENERGY CONSERVATION

Introduction – nuclear fission and fusion – chain reaction – radio activity – layout of nuclear power plant – merits and demerits – nuclear reactors – components – reactor core – moderators – control rods – coolant – reflectors – biological shield – reactor vessels – classification of reactor pressurized water reactor – boiling water reactor – Candu type reactor – fast breeder reactor – effect of nuclear radiation – fuel cycle – site selection – safety – floating nuclear power plants – Uranium enrichment – methods – disposal of nuclear wastes – comparison of nuclear power plants with thermal power plants

Energy audit: introduction – types of energy audit – walk through energy audit – intermediate energy audit – benefits of energy audit – energy conservation – introduction – listing of energy conservation – opportunity – methods of energy conservation – merits and demerits

Text Books:

- 1) Thermal Engg, R.K. Rajput, 8th Edition, Laxmi publications pvt Ltd, New Delhi.
- 2) Thermal Engineering, RS Khurmi & JK Gupta, 18th Edition, S.Chand & Co, New Delhi.
- 3) Power plant Engineering, G.R. Nagpal, Khanna Publishers, New Delhi.
- 4) Refrigeration and Air conditioning, P L Ballaney, 4th Edition, Khanna Publishers, New Delhi.

Reference Books:

- 1) Thermal engineering, P.L Ballaney, 24th Edition, Khanna Publishers, New Delhi.
- 2) Thermal engineering, B.K. Sarkar, 3rd edition, Dhanpat Rai & Sons New Delhi.
- 3) Power Plant Engineering, Domkundwar & CP Kothandaraman, 2nd Edition, Khanna Pub. New Delhi.
- 4) Refrigeration and Air conditioning, Manohar Prasad.
- 5) Power Plant Engineering, P.C. Sharma, S.K. Kataria & sons, New Delhi.

Instruction Hours	80 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	90 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-522 DESIGN OF MACHINE ELEMENTS

SUBJECT	INSTRUCTIONS		EXAMINATION		
R5-522 DESIGN OF MACHINE ELEMENTS	Hours / Week	Hours / Sem	Marks		
		90 Hrs	Internal Assessment	External Exam	Total
					Duration

	6 Hrs		25	75	100	3 Hrs
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Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	DESIGN OF JOINTS AND FASTENERS	16
II	DESIGN OF SHAFTS, COUPLINGS AND KEYS	16
III	DESIGN OF FRICTION DRIVES (Flat belts and V-belts)	16
IV	DESIGN OF BEARINGS	16
V	DESIGN OF LEVERS AND SPUR GEARS	16
Total Instruction Hours		80

UNIT - I**DESIGN OF JOINTS AND FASTENERS****16 Hrs**

Classification of engineering materials – factors affecting selection of material – BIS designation of ferrous materials – preferred number – factor of safety and allowable stress – procedure for designing machine elements – types of failures – problems on tension, compression, shear and bearing

Joints: Design of – sleeve and cotter joint – knuckle joint – welded joint. **Fasteners:** Design of bolted joints – eye bolts – cylinder cover with bolts, studs – pins

UNIT - II**DESIGN OF SHAFTS, COUPLINGS AND KEYS****16 Hrs**

Shafts: Design of shafts subjected to – twisting moment – bending moment – combined twisting and bending moments – fluctuating loads – design of shafts based on rigidity.

Keys: Types of keys – design of sunk keys only – effect of keyways on shaft – problems.

Couplings: Requirements of good couplings – types – design of – rigid protected type flange couplings – marine couplings – pin type flexible coupling (description only).

UNIT - III**DESIGN OF FRICTION DRIVES (Flat belts and V-belts)****16 Hrs**

Flat Belts: Types of belts – materials for belt – types of belt drives – Speed ratio – effect of slip – length of flat belts – tension ratio – centrifugal tension – power transmitted – condition for maximum power – transmission – initial tension – problems – design procedure of flat belts – design of flat belt based on basic equations and manufacturer's data – problems

V-Belts: V-belt drive – comparison with flat belt drive – designation of V belts – length of belt – power transmitted – design of V-belt using manufacturer's data only – problems

UNIT - IV**DESIGN OF BEARINGS****16 Hrs**

Bearings: Classifications of bearings – sliding contact and rolling contact bearings – radial and thrust bearings – roller bearing – types – designation of ball bearings –

materials used for bearings – journal bearings – heat generated – heat dissipated – cooling oil requirement – problems – design of journal bearings – problems

UNIT - V

DESIGN OF LEVERS AND SPUR GEARS

16 Hrs

Levers: Types of levers – applications – mechanical advantage – leverage – displacement ratio – design of – hand lever – foot lever – cranked lever – problems

Spur gears: Gear drives – merits and demerits over belt drive – classification of gears – gear materials – spur gear terminology – design of spur gears based on Lewis & Buckingham equation – problems – speed reducer – types

Text Books:

- 1) Machine Design, Pandya & Shah, Edn. 1995, Charotar Publishing House.
- 2) Machine Design, TV Sundararamoorthy & N. Shanmugam, Revised Edition June-2003–Anuradha Publications, Kumbakonam.
- 3) Design Data Book – PSG College of Technology, DPV Printers, Coimbatore.

Reference Books:

- 1) A text book of Machine Design, R.S. Khurmi & J.K. Gupta, 18Ed, Euroasia Pub, New Delhi-110 055.
- 2) Machine Design - Bandari,
- 3) Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum's outline Series.

Examination Pattern:

PATTERN OF QUESTION PAPER

1. **Five** questions will be asked, one question from each unit in **either or pattern**. All the five questions are to be answered.
2. Each question carries 15 marks. These questions may have sub-divisions also.
3. Approved Design Data book is permitted

Instruction Hours	80 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	90 Hours

R5-523 PROCESS PLANNING AND COST ESTIMATION

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-523 PROCESS PLANNING AND COST ESTIMATION	5 Hrs	75 Hrs	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
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I	PROCESS PLANNING	13
II	PROCESS SELECTION	13
III	WORK STUDY	13
IV	COST ESTIMATION	13
V	MACHINING TIME CALCULATIONS	13
Total Instruction Hours		65

UNIT - I

PROCESS PLANNING

13 Hrs

Introduction – concept – Information required to do process planning – factors affecting process planning – process planning procedure – make or buy decision using break even analysis – simple problems – manual process planning – introduction of automated process planning and generator process planning – advantages of computer aided process planning – principle of line balancing – need for line balancing – Value Engineering – definition – cost control vs cost reduction – value analysis when to do – steps information needed – selection of product

UNIT - II

PROCESS SELECTION

13 Hrs

Process selection – technological choice – specific component choice – process flow choice – factors affecting process selection – machine capacity – analysis of machine capacity – process and equipment selection procedure – determination of man, machine and material requirements – simple problems – selection of material – jigs – fixtures etc. – factors influencing choice of machinery – selection of machinery – simple problems – preparation of operation planning sheet for simple components

UNIT - III

WORK STUDY

13 Hrs

Objectives of work study – concept of work content – techniques to reduce work content – method study – procedure – recording techniques used in method study – Micro motion study – principles of motion economy – Therbligs – Simo chart – cycle graph – Chrono cycle graph – work measurement – basic procedures for the conduct of time study – calculation of standard time – simple problems – Ergonomics – definition – objectives – applications – working environment – work place layout – other areas

UNIT - IV

MACHINING TIME CALCULATIONS

13 Hrs

Elements of metal machining – cutting speed – feed – depth of cut – procedure for assigning cutting variables – calculation of machining time for different lathe operations like – turning – facing – chamfering – parting – knurling and forming – calculation of machining time for operations on drilling machine – machining time for shaping, planing, slotting, broaching and sawing operations – machining time for face milling and slab milling operations – timing for thread cutting – estimation of total unit time – procedure for doing the above machining calculations with formulae used – simple problems

UNIT - V COST ESTIMATION

13 Hrs

Introduction – definition – purpose of cost estimation – cost estimation Vs cost accounting – components of cost – direct cost – indirect cost – overhead expenses – estimation of cost elements – set up time and economic lot size – tool change time – inspection time – performance factor – overheads – different methods of apportioning overheads – data required for cost estimating – steps in making a cost estimate – problems – estimation of production cost of simple components such as coupling, shaft, crank etc. – problems

Text Books:

- 1) Industrial Engineering & Management - O.P Khanna
- 2) Mechanical and Estimating – Banga & Sharma

Reference Books:

- 1) Process planning and cost estimation – M.Adhithan, New age publishers.
- 2) Process planning and cost estimation – R.Kesavan, New age publishers.
- 3) Production Engineering – P C Sharma.
- 4) Industrial Engineering & Production Management - Martand Telsang
- 5) Production and Casting – GBS Narang and V Kumar

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-524.1 ELECTIVE THEORY - I AUTOMOBILE ENGINEERING

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-524.1 AUTOMOBILE ENGINEERING	5 Hrs	75 Hrs	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	AUTOMOBILE ENGINES	13
II	FUEL & FUEL FEED SYSTEMS	13
III	TRANSMISSION & POWER TRAINS	13
IV	AUTOMOBILE CHASSIS AND RELATED PARTS	13
V	AUTOMOBILE ELECTRICAL EQUIPMENT & POLLUTION CONTROL	13
Total Instruction Hours		65

UNIT - I

AUTOMOBILE ENGINES

13 Hrs

Basic engine components – functions, types, materials and construction of – cylinder block – crankcase – oil pan – cylinder head – gasket – cylinder liners – comparison of liners – piston – expansion control in pistons – piston rings – types of compression rings and oil control rings – piston pin – connecting rod – method of connecting piston and connecting rod – crank shaft – flywheel, dual mass fly wheel – cam shaft – methods of cam shaft drive arrangements – valve and valve mechanism – L – I – F – T

Diesel engine – stages of combustion – delay period – variables affecting delay period – methods of generating air swirl in diesel engine combustion chambers – types of combustion chambers – merits and demerits

Cooling systems – purpose – types – air and water cooling systems – merits and demerits pump assisted water cooling systems – components – water pump – fan – Thermostat – types – Radiator – types – pressure cap – vapour recovery cooling system – merits – vented and pressurized expansion tank – anti-freezing solutions – temperature sensors – troubles in cooling system – loss of coolant, overheating and over cooling – causes

Lubrication systems – purpose – types of lubricants – Additives – service rating of oil – types of lubricating systems – full pressure system – techniques of cylinder and piston lubrication – oil pump – oil filters – full flow and bypass filter systems – troubles in lubrication system – oil leakage, low oil pressure, high oil pressure and excessive oil consumption – causes

UNIT - II

FUEL & FUEL FEED SYSTEMS

13 Hrs

Requirements of an ideal petrol – octane number – Detonation – pre-ignition – properties of a good diesel fuel – Cetane number – diesel knock – methods of controlling diesel knock – comparison of detonation and diesel knock – fuel additives – alternate fuels for petrol and diesel engines

Layout of feed system of petrol engine – types of fuel feed system – AC mechanical fuel pump – fuel filter – air cleaners – types – carburetion – classification of carburetors – simple carburetor – defects – carburetor circuits – Solex carburetor – construction and operation – petrol injection – merits and demerits – DTSI – VT – CCVTI – PGMFI – MPFI system

Layout of diesel fuel feed system – single acting fuel feed pump – fuel injection pumps – construction and working of distributor type pump – CRDI system – fuel injectors – types – single and multi hole – pintle and pintaux – solenoid type injector – Piezo-electric injector

UNIT - III

TRANSMISSION & POWER TRAINS

13 Hrs

General arrangement of power transmission system – arrangement of front engine rear drive – rear engine rear drive – front engine front drive – four wheel drive – all wheel drive – applications

Clutch – function – components – types – single plate clutch – multi plate clutch – diaphragm spring clutch – torque convertor – clutch troubles and their causes.

Gear box – purpose – various resistance to motion – types of gear boxes – sliding mesh, constant mesh and synchromesh gear boxes – floor shift gear changer – gear box troubles and their causes

Drive line – propeller shaft – universal joint – cross type and constant velocity joint – slip joint – final drive – function – types of gear arrangement – straight and spiral bevel, hypoid worm and worm wheel – merits, demerits and application – Hotch-kiss drive – Torque tube drive – radius rod – transaxle transmission

Differential – purpose – construction and operation – self locking and non slip differential – differential troubles and their causes – forces in the rear axle – semi floating, three quarter floating and full floating rear axles – axle housing – types

UNIT - IV

AUTOMOBILE CHASSIS AND RELATED PARTS

13 Hrs

Front axle – types – stub axle – types – steering system – Ackerman principle of steering – wheel alignment – factors – camber, caster, king pin inclination, toe-in and toe-out on turns – steering linkages – steering gears – cam and double roller, recirculating ball type – rack and pinion – steering troubles and causes – power steering – necessity – types – layout of any one type – collapsible steering system

Suspension system – functions – types of springs – leaf, coil and torsion bar – front suspension systems – independent front suspension – types – merits and demerits – rear end suspension – air suspension – shock absorber – purpose – telescopic type – construction and working

Brake system – functions – classification of brakes – drum brakes – leading shoe and trailing shoe – self energizing action – hydraulic brake – brake bleeding – air assisted hydraulic brakes – air brake – layout, functions of each component and application only – disk brake – construction and working – comparison of disk and drum type brake – brake troubles and their causes – Anti-lock Brake System (ABS)

Wheels – types of wheels – brief description and applications – tyres – functions – construction of tyres – cross and radial ply tyres – comparison – properties of tyres – tubeless tyres – tyre wear and tyre service – tyre inflation – nitrogen filled tyre

UNIT - V

AUTOMOBILE ELECTRICAL EQUIPMENT & POLLUTION CONTROL

13 Hrs

Battery – lead acid battery – construction – starting circuit – construction and operation of starter motor – starting motor drives – over running clutch and bendix drive – construction and operation – solenoid switch – charging circuit – alternator – construction and operation – regulators – dynamo

Ignition system – types – battery coil ignition system – high tension magneto ignition system – electronic ignition – ignition system troubles and remedies – distributor less ignition

Lighting system – circuit – head light – aiming and adjustment – sealed beam head lights – directional signal circuits – fluorescent lamp – horn circuits – windscreen wiper

Pollution – pollutants – source of pollutants – pollution control techniques for petrol and diesel engines emissions – controlling crank case emission (PCV) – controlling evaporative emission (VRS, VSS, VVR, ECS and EEC) – treatment of exhaust gas (Catalytic converter, EGR) – introduction to automobile electronics – radio interference – suppressors – audio, video systems

Text Books:

- 1 Automobile Engineering vol-1, vol -2, Kirpal Singh, Standard Publishers & distributors, New Delhi
- 2 Automobile Engineering, G.B.S Narang, Kanna publishers, New Delhi

- 3 Automotive Mechanics , William H.Crouse and Donald .L. Anglin , Tata Mc Graw Hill, New delhi
- 4 The Automobile, Herban Singh and reyat , S Chand and Co Ltd , New Delhi

Reference Books:

- 1 Vehicle and Engine Technology. Vol .I , Heinz Heisler, ELBS
- 2 Automotive Mechanics, Joseph Heitner, East-West press (P) Ltd, New Delhi
- 3 Internal Combustion Engines, M.L.Mathur and R.P. Sharma, Dhanpat Rai and Sons, New Delhi
- 4 Automobile Engineering, R.B.Gupta, Satyaprakashan , New Delhi

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-524.2 ELECTIVE THEORY - I FOUNDRY TECHNOLOGY

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-524.2 FOUNDRY TECHNOLOGY	5 Hrs	75 Hrs	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	PATTERNS AND METHODING	13
II	MOULDING, CASTING AND ADVANCED METAL CASTING PROCESSES	13
III	FOUNDRY PRACTICE OF FERROUS AND NON-FERROUS MATERIALS	13
IV	MECHANIZATION AND AUTOMATION OF FOUNDRIES	13
V	CASTING DEFECTS AND INSPECTION OF CASTINGS	13
Total Instruction Hours		65

UNIT - I PATTERNS AND METHODING

13 Hrs

Types of pattern – pattern materials – pattern allowances – functions of patterns – core prints and core boxes – methods of constructing patterns – pattern storage – moulding sand and core sand – general properties – binders – sand additives – natural and synthetic sands – parting compounds – mould and core wash – sand testing – sand control – preparation of sand – introduction to casting methoding

UNIT - II

MOULDING, CASTING AND ADVANCED METAL CASTING PROCESSES 13 Hrs

Different moulding and casting processes sand castings – green sand moulding, dry sand moulds, floor and pit moulding – cement – bonded sand moulds – gating systems – solidification – of pure metal and alloys – directional solidification – core moulds – CO₂ processes – shell moulding – investment casting – ceramic shell moulds – ceramic moulding – plaster moulding – Antioch process – graphite moulds – permanent moulds – gravity permanent mould casting – slush casting pressed or corthias casting – pressure die casting – centrifugal casting – continuous casting – casting design – safety factors in casting design – economic considerations in casting design – hybrid evaporative pattern casting process – Vacuum Assisted Evaporative Pattern Casting process (VAEPC) – lost foam casting – squeeze casting – single crystal casting

UNIT - III

FOUNDRIY PRACTICE OF FERROUS AND NON-FERROUS MATERIALS 13 Hrs

Steel foundry practice – steel melting – deoxidization – tapping and pouring – cast iron – types of cast iron – melting of cast iron – principles of cupola operation – tapping and slagging – chemical principles of cast iron melting – air furnace melting – casting of non ferrous metal – aluminum foundry practice – advantage and limitation of aluminum casting – melting of aluminum – melting furnaces – melting procedure – casting properties of aluminum alloys – copper alloy foundry practice – temperature control – selection of furnace – factors affecting choice of furnace – converters – laddles – pouring the molten metal – gases in cast metals – prevention of gas absorption – foundry refractory – temperature measurement of furnace and metals – cleaning, chipping and grinding of castings – repair of castings – heat – treatment of cast metals – joining of cast metals

UNIT - IV

MECHANIZATION AND AUTOMATION OF FOUNDRIES 13 Hrs

Approach to modernization and mechanization – elements of mechanization – foundry equipment – sand muller, aerator – sand reclamation – equipment for fume – dust extraction – moulding and core making equipment – machine moulding – core drawing machines – continuous core making machines – sand slinger for cores – recirculation drying stoves – core shop mechanization – robots used to minimize manual labour – material handling equipment and conveyor systems – pollution control – environmental protection – air quality – water quality – noise – health & safety

UNIT - V

CASTING DEFECTS AND INSPECTION OF CASTINGS 13 Hrs

Various casting defects – causes and remedies – surface imperfections – defects due to incomplete feeding – gas porosity – external hot tears, cold cracks and warpage – unfused chills and chaplets – moulding defects – defects caused by moulding, core making and gating – defects due to mould drying and core baking – defects caused during closing and pouring of moulds – defects caused by molten metal – defects due to wrong fettling operations – defects caused by faulty heat treatment

Inspection of castings: Purpose of inspection – methods of inspection – destructive and non destructive – visual and surface inspection – dimensional inspection – metallurgical inspection – chemical analysis – casting soundness – pressure testing – radiographic inspection – ultrasonic inspection – magnetic particle inspection – dye penetrant

inspection – mechanical property testing – salvage – quality control in foundries – general considerations and features of quality control

Text Books:

1. Foundry Engineering –T.R. Banga, R.L. Agarwal, T. Manghnani –Khanna Publishers.
2. Foundry Engineering – N.K. Srinivasan - Khanna Publishers.

Reference Books:

1. Principles of Metal casting – Richard .W. Heine, Carl R. Ioper, Philip C.Rosenthal -Tata McGraw Hill.
2. Foundry Engineering –Howard F. Taylor, Merton C. Flemings, John Wulff – Wiley Eastern.
3. Principles of Foundry Technology – 4th Edition, P.L.Jain -Tata McGraw Hill.
4. Foundry Technology – 2nd Edition, Peter R. Beeley – Bitterworth Heinman Publication.
5. Casting Technology & Cast alloy – A K Chakrabati – PHI Learning Pvt Ltd

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-524.3 ELECTIVE THEORY - I REFRIGERATION & AIR CONDITIONING

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
R5-524.3 REFRIGERATION & AIR CONDITIONING			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	13
II	VAPOUR COMPRESSION REFRIGERATION SYSTEM, VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	13
III	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	13
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	13
V	COOLING LOAD CALCULATIONS AND DUCT DESIGN, ENERGY CONSERVATION TECHNIQUES	13
Total Instruction Hours		65

UNIT - I**REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS****13 Hrs**

Thermodynamic state of a pure substance – modes of heat transfer – laws of heat transfer – mechanisms of production of cold – unit of refrigeration – types of refrigeration – reversed Carnot cycle – COP of heat engine – heat pump refrigerating machine – principle of working of open and closed air system of refrigeration – advantages and disadvantages – and its application of air cycle problems. Compressor – principle of working and constructional details of reciprocating and rotary compressors – hermetically and semi hermetically sealed compressors. Condensers – principle of working and constructional details of air cooled and water cooled condensers, evaporative condensers – advantages and disadvantages – natural and forced draught cooling towers. Evaporators – natural circulation and forced circulation type – principle of working constructional details

UNIT - II**VAPOUR COMPRESSION REFRIGERATION SYSTEM, VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS** 13 Hrs

Principle of working of vapour compression system – analysis of vapour compression cycle using T-s diagram and p-H diagram – refrigerating effect compression work – COP – effect of superheating and under cooling – effect of evaporative pressure and condenser pressure – problems – liquid vapour refrigeration heat exchangers – advantages and disadvantages of superheating and under cooling – use of flash chamber and accumulator. Simple absorption system – Electrolux system – solar absorption refrigeration system – absorption system comparison with mechanical refrigeration system – refrigerators for above 2 K – Philips Refrigerator – Gifford McMonaghan refrigerator – refrigerators for below 2 K – magnetic refrigeration systems

UNIT - III**REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION** 13 Hrs

Capillary tube – automatic expansion valve – thermostatic expansion valve electronic expansion valve – solenoid valve – evaporator pressure regulator – suction pressure regulator – classification of refrigerants – selection of refrigerant – properties and applications of following refrigerants SO₂, CH₄, F22 and NH₃ – CFCs refrigerants – equivalent of CFCs refrigerants (R-123a, R-143a, R-69S) – blends of refrigerants (R500 and R500 Series) – lubricants used in refrigeration and their applications
Slow freezing – quick freezing – cold storage – frozen storage – freeze drying – dairy refrigeration – ice cream cabinets – ice making – water cooler, milk cooler, bottle cooler – frost free refrigeration

UNIT - IV**PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS****13 Hrs**

Psychrometry properties – adiabatic saturation of air by evaporation of water psychrometric chart and its uses – psychrometric processes – sensible heating and cooling – humidifying and heating – dehumidifying and cooling – adiabatic cooling with humidification – total heating or cooling processes – sensible heat factor – by pass factor

– adiabatic mixing – evaporative cooling – problems – governing optimum effective temperature – comfort chart – design consideration
 Equipment for air conditioning and insulation factors – air purification – temperature control – humidity control – dry and wet filters – centrifugal dust collector – air washer humidifier – dehumidifier – fans and blowers – grills and registers – summer and winter air conditioning – window and split air conditioners – properties of ideal insulator – types of insulating materials

UNIT - V

COOLING LOAD CALCULATIONS AND DUCT DESIGN, ENERGY CONSERVATION TECHNIQUES

13 Hrs

Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load – infiltration air load – miscellaneous heat sources – fresh air load – problems – classification of duct systems – duct design – equal friction method – velocity reduction method – problems – chilled water systems – air handling units
 Energy conservation and design decisions – heat reclaim – thermal storage – ice builder – ice harvester – variable refrigerant flow (VRF) – variable primary flow (VPF)

Text Books:

- 1) Refrigeration and Air Conditioning, P.L. Ballaney, Khanna Publishers, New Delhi 110 006
- 2) Refrigeration and Air Conditioning, V.K. Jain,
- 3) "Industrial Refrigeration Hand Book", Wilbert F. Steocker

Reference Books:

- 1) A Course in Refrigeration and Air Conditioning, Domkundwar,
- 2) Principles of Refrigeration, Dossat,
- 3) Home Refrigeration and Air Conditioning, Audels, Theo. Audel & Co. publisher, 1996 New York. - 1998
- 4) Refrigeration and Air Conditioning, C.P Arora,

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-525 THERMAL POWER ENGINEERING PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
R5-525 THERMAL POWER ENGINEERING PRACTICAL	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

List of Experiments:

PART - A

1. Determine flash and fire point of the given oil using open cup apparatus

2. Determine flash and fire point of the given oil using closed cup apparatus
3. Determine the absolute viscosity of the given lubricating oil using Redwood viscometer
4. Determine the absolute viscosity of the given lubricating oil using Saybolt viscometer
5. Port timing diagram of two stroke petrol engine
6. Valve time diagram for four stroke petrol engine
7. Valve time diagram for four stroke diesel engine

PART - B

8. Load test (Performance test) on four stroke petrol engine
9. Load test (Performance test) on four stroke diesel engine
10. Morse test on Multi-cylinder petrol engine
11. Heat balance test on four stroke petrol engine
12. Heat balance test on four stroke diesel engine
13. Volumetric efficiency of Air compressor
14. Thermal conductivity measurement using guarded plate apparatus
15. Determination of COP of refrigeration system

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Part – A and one from Part – B. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
1	One question from PART - A	35 marks
2	One question from PART - B	35 marks
3	Viva-voce	05 marks
TOTAL		75 marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-526.1 ELECTIVE PRACTICAL - I AUTOMOBILE ENGINEERING PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-526.1 AUTOMOBILE ENGINEERING PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

EXERCISES

PART – A

1. Identification and application of mechanic's tools
2. Dismantling and assembling of four stroke petrol engine and identification of parts
- 3 Dismantling and assembling of four stroke diesel engine and identification of parts
- 4 Cleaning, inspecting and measuring cylinder bore using cylinder bore dial gauge and suggesting the next over size
- 5 Removing decarborising, inspecting and replacing connecting rods and adjusting the bearings
- 6 Removing camshaft, replacing timing gears, adjusting valve clearance
- 7 Removing, servicing and replacing of oil pump & water pump
- 8 Removing, servicing and replacing of AC fuel pump
- 9 Removing, servicing & replacing SOLEX carburetor/MPFI system
- 10 Dismantling and assembling of inline fuel injection pump/ CRDI system
- 11 Dismantling, assembling and testing of injectors

PART – B

1. Removing and replacing of pressure plate and clutch plate, fingers adjustment
2. Dismantling, inspecting and assembling of gear box and find out the gear ratios
3. Dismantling, inspecting and assembling of final drive and differential units
- 4 Adjusting backlash and correct tooth contact of crown & pinion of differential unit
- 5 Dismantling, assembling and adjusting of steering gear box and find gear ratio
- 6 Test a battery with specific gravity test and charge the battery with constant amperage / voltage method
- 7 Dismantling, overhauling and assembling of starter motor.
- 8 Dismantling, overhauling and assembling of alternator
- 9 Dismantling, overhauling and assembling of dynamo
- 10 Trace the automobile electrical system with respect to battery coil ignition system
- 11 Trace the automobile electrical system with respect to horn relay circuit, Wiper circuit & explain with neat circuit diagram.

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Part – A and one from Part – B. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
1	One question from PART - A	35 marks
2	One question from PART - B	35 marks
3	Viva-voce	05 marks
TOTAL		75 marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-526.2 ELECTIVE PRACTICAL - I FOUNDRY TECHNOLOGY PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-526.2 FOUNDRY TECHNOLOGY PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

PART A

FOUNDRY PRACTICE LAB:

25 Hrs

1. Practice in ramming of sand in mould boxes to obtain level and smooth surface using spirit level.
2. Cube (single piece pattern)
3. Flange in box moulding using a pattern
4. Pipe with the use of split pattern and core box
5. T pipe split pattern and core box
6. Gear wheel and pulley
7. Pipe fittings and cocks
8. Grooved pulley using draw back method
9. Loose piece pattern
10. Sweep pattern

CORE MAKING:

1. Practice in CO₂ sand mould preparation
2. Pattern making in wood with allowances
3. Loam moulding process

4. Shell moulding process
5. Investment casting process
6. Special casting process by using thermocoal patterns

PART B**MELTING PRACTICE LAB:****25 Hrs**

1. Study of construction and operation of cupola furnace
2. Study of construction and operation of pit type crucible furnace
3. Study of rotary melting furnace
4. Study of high frequency induction furnace
5. Study of furnaces for heat treatment
6. Making of cast iron castings by using Cupola

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Part – A and one from Part – B. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
1	One question from PART - A	35 marks
2	One question from PART - B	35 marks
3	Viva-voce	05 marks
TOTAL		75 marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-526.3 ELECTIVE PRACTICAL - I
REFRIGERATION AND AIR CONDITIONING PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-526.3 REFRIGERATION AND AIR CONDITIONING PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	

PART-A**1. BASIC REFRIGERATION WORKSHOP OPERATION:**

(a) Copper and steel tubing

-To study the various sizes of copper and steel tubing.

- To study the various tools used for operations.
- To become familiar with various operations on copper and steel tubing –
Flaring, Swaging.

(b) Soldering methods used in R & AC

2. TO STUDY THE CONSTRUCTION FEATURES OF THE FOLLOWING:

- (a) Domestic refrigerators
- (b) Water coolers
- (c) Window Air Conditioner
- (d) Split Type Air-Conditioner

3. PROPER METHODS OF SETTING AND ADJUSTING OF

- (a) Thermostats
- (b) Low pressure and high pressure cut-outs
- (c) Thermostatic expansion valve
- (d) Automatic Expansion Valve

PART-B

1. TEST PROCEDURES

- I) To determine the refrigerating effect, COP and the compressor capacity of a open type system with
 - i) Thermostatic expansion valve
 - ii) Capillary tube
 - iii) Automatic expansion valve
- II) To determine the COP of sealed system by using electrical measurements
 - i. To determine the capacity of a window air conditioner.
 - ii. To determine the efficiency of a cooling tower.
 - iii. Wiring of refrigerator, water cooler, desert cooler, room air conditioner -packaged air conditioner, panel board etc.

2. SERVICE PROCEDURES

- i) To change refrigerant into service cylinder from storage cylinder.
- ii) To evaluate the entire system
- iii) To Pump down the system
- iv) To Purge air from the system

- v) To locate the leaks in a system.
- vi) To charge the system
- vii) To check the oil level in the compressor.
- viii) Tracing the common faults in R & AC units and their remedies.

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Part – A and one from Part – B. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
1	One question from PART - A	25 marks
2	One question from PART - B	45 marks
3	Viva-voce	05 marks
TOTAL		75 marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-527 LIFE AND EMPLOYABILITY SKILLS PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-527 LIFE AND EMPLOYABILITY SKILLS PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Sl. No.	Topics	Hours
1	Part – A: LISTENING ACTIVITY TOPICS: Global Warming, Pollution, Environment	12
2	Part – B: SPEAKING ACTIVITY TOPICS: Communication; Behavioural Skills; Productivity – Comparison with developed countries; Occupational Safety, Health Hazard; Accident & Safety, First-Aid;	28
3	Part – C: WRITING AND READING ACTIVITY TOPICS: Facing Interviews; Entrepreneurship and Project Preparation	08
4	Part – D: GOOGLE SEARCH AND PRESENTATION in Record note (for Continuous Assessment as Assignments on any five topics) TOPICS: Productivity; Quality Tools, Quality Circles, Quality	12

	Consciousness; Labour Welfare Legislation, Labour Welfare Acts; Gender Sensitisation (a. Important Constitutional & Legal Provisions for Women in India, b. Harassment of Women at Workplace (Prevention & Prohibition & Redressal) Act 2013, c. Guidelines & Norms laid down by Hon'ble Supreme Court in Vishaka and Others, d. National Commission for Protection of Child Rights (NCPCR), e. Protection of Children from Sexual Offences (POCSO) Act & Rule 6 of POCSO Rules, 2012.	
TOTAL		60 Hrs

TOPICS AND ALLOCATION OF HOURS:

S.No	Section	Skills to be Acquired	Activity	No. of Hours
1	Part – A LISTENING ACTIVITY TOPICS: Global Warming, Pollution, Environment	<ul style="list-style-type: none"> • Deductive / Reasoning Skills • Cognitive Skills • Retention Skills 	<ul style="list-style-type: none"> • Taking down notes / hints • Answering questions • Fill in the blanks the exact words heard 	04 04 04
2	Part – B SPEAKING ACTIVITY TOPICS: Communication; Behavioural Skills; Productivity – Comparison with developed countries; Occupational Safety, Health Hazard; Accident & Safety, First-Aid;	<ul style="list-style-type: none"> • Personality/Psychological Skills • Pleasing & Amiable Skills • Assertive Skills • Expressive Skills • Fluency/Compatibility Skills • Leadership/Team Spirit Skills 	<ul style="list-style-type: none"> • Instant sentence making • Say expressions /phrases • Self introduction/ another higher official in company • Describe/explain products • Dialogues on technical grounds • Discuss & interact • Group Discussion 	02 02 04 06 06 08
3	Part – C READING AND WRITING ACTIVITY TOPICS: Facing Interviews; Entrepreneurship and Project Preparation	<ul style="list-style-type: none"> • Creative & Reasoning Skills • Creative & Composing Skills • Attitude & Aim Skills • Entrepreneurship Skills 	<ul style="list-style-type: none"> • Frame questions based on patterns • Make sentences based on patterns • Prepare a resume • Prepare an outline of a project to obtain loan from bank in becoming an entrepreneur 	02 02 02 02
4	Part – D GOOGLE SEARCH AND PRESENTATION in Record note (for Continuous Assessment as Assignments on any five topics) TOPICS: Productivity; Quality Tools, Quality Circles, Quality consciousness; Labour Welfare Legislation, Labour Welfare Acts; Gender Sensitisation (a. Important Constitutional & Legal Provisions for Women in	<ul style="list-style-type: none"> • Cognitive Skills • Presentation Skills& • Interactive Skills 	<ul style="list-style-type: none"> • Search in the website • Prepare a presentation • Discuss & interact • Record as assignment 	12

India, b. Harassment of Women at Workplace (Prevention & Prohibition & Redressal) Act 2013, c. Guidelines & Norms laid down by Hon'ble Supreme Court in Vishaka and Others, d. National Commission for Protection of Child Rights (NCPCR), e. Protection of Children from Sexual Offences Act & Rule 6 of POCSO Rules, 2012.			
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LEARNING STRUCTURE**100 Marks**

- Focus more on Speaking & Listening Skills
- Attention less on Reading & Writing Skills
- Apply the skills in fulfilling the Objectives on Focused Topics

a) Listening**25 Marks**

1. Deductive Reasoning Skills (taking down notes/hints)	10
2. Cognitive Skills (answering questions)	10
3. Retention Skills (filling in blanks with exact words heard)	05

b) Speaking Extempore / Prepared**30 Marks**

1. Personality/Psychological Skills (instant sentence making)	05
2. Pleasing & Amiable Skills (say in phrases/expressions)	05
3. Assertive Skills (introducing oneself/others)	05
4. Expressive Skills (describe/explain things)	05
5. Fluency/Compatibility Skills (dialogue)	05
6. Leadership/Team Spirit Skills (group discussion)	05

c) Writing & Reading**20 Marks**

1. Creative & Reasoning Skills (frame questions on patterns)	05
2. Creative & Composing Skills (make sentences on patterns)	05
3. Attitude & Aim Skills (prepare resume)	05
4. Entrepreneurship Skills (prepare outline of a project)	05

d) Continuous Assessment (Internal Marks)**25 Marks**

(search, read, write down, speak, listen, interact & discuss)

1. Cognitive Skills (Google search on focused topics)
2. Presentation Skills & Interactive Skills (after listening, discuss)

Total Marks:**100 Marks****CONTINUOUS ASSESSMENT (INTERNAL MARKS)**

I	LISTENING (3 exercises), SPEAKING (6 exercises) and READING & WRITING (4 exercises). All activities shall be recorded in the Record note. 13 exercises x 10 marks = 130 marks. Reduced to 10 marks	10 Marks
II	Present in the Record Note on any 5 topics prescribed in syllabus as Assignments Topics. 5 Assignments x 10 Marks = 50 marks. Average of 5 Assignments is 10 marks	10 Marks
III	Attendance	05 Marks
Total		25 Marks

MODEL QUESTION**Time: 3 Hours****Maximum Marks: 75****A. LISTENING****25 Marks**

1. Listen to the content and take down notes/hints 10
2. Listen to the content and answer the following questions. 10
3. Listen to the content and fill in the blanks the exact words heard. 05

B. SPEAKING**30 Marks**

1. Say in a sentence instantly on hearing the word (5 words, one after another). 05
2. Say any five expressions commonly used in communication. 05
3. Imagine, a consultant has come to your Dept. Introduce him to your subordinates. 05
4. Explain/describe the product you are about to launch in the market. 05
5. Speak with your immediate boss about the progress you have made. 05
6. Discuss within the group on the topic of focus prescribed in the syllabus. 05

C. WRITING & READING**20 Marks**

1. Make sentences from the pattern given by changing sets of words with your own. 05

1.	When	do	you	return?
b.	How	is	his performance?	
c.	Where	has	the manager	gone?
d.	What	is	the progress	today?
e.	Why	are	the machines	not

2. Make sentences from the pattern given by changing sets of words with your own. 05

a	The workers	are	on strike		
b	The labourers	are paid	well	in this factory	
c	There	is	a rest room	for the workers	
d	These	are	the new products	launched	by our company
e	Almost everyone	came	to the company	on motorbikes	

3. Prepare a resume for the post of Department Manager. 05
4. Prepare an outline of a project to obtain a loan. (Provide headings and subheadings) 05

I. Guidelines for setting the question paper:**A. LISTENING:**

Only Topics related to POLLUTION / ENVIRONMENT / GLOBAL WARMING are to be taken for listening section. The same after / Topic should not however be repeated in the above 3 Listening Activities.

B. SPEAKING:

1. WORDS of common usage
2. Fragments – expression of politeness, courtesy, cordiality
3. Introduce yourself as an engineer with designation or Introduce the official visiting your company/department
4. Describe/Explain the product/machine/department
5. Dialogue must be with someone in the place of work.
6. Group of six/eight Discuss the focused topic prescribed in the syllabus

C. WRITING & READING:

1. Provide five different structures.
Students are to substitute at least one set with some other word/words
2. Provide five different structures.
Students are to substitute at least one set with some other word/words

3. Provide some post related to industries.
4. Outline of the project (skeleton/structure) Only the various headings and subheadings
Content is not needed

II. Conduct of End Practical Examination with Allocation of time for each Part:

PART – C. WRITING & READING:

Firstly, the students are seated after all the formalities are completed and they shall be asked to write on the answer paper the Written & Reading (Part - C) for half an hour.

DURATION: 30 Minutes + (15 extra minutes, while other student attends Speaking Part)

PART – A. LISTENING:

Secondly, after 30 minutes of the Start of the Examination, they may be asked to stop Writing and shall be directed to start the Listening (Part – A) of the End Examination on a separate sheet of paper. They shall also be given instructions that once the Listening Part is completed their papers shall be collected. The First of the Listening Topic decided by both external and internal Examiners shall be read to the students for three to five minutes. As they listen they can take down notes. They shall be given 10 minutes to restructure the notes, if necessary. Then, the Second Listening Topic (a different topic) shall be read to the students. They shall be asked to write the answers for the 5 questions given one after another within 10 minutes. Next, the Third topic (a new topic) is read to the students. Then they are dictated the sentences with 5 blanks, on which they shall fill in the exact word heard. This shall be completed in 10 minutes. Thus the LISTENING PART can be completed in 45 Minutes. The Listening part of the answer papers are collected from the students, immediately after.

DURATION: 45 Minutes

PART – B. SPEAKING

Thirdly, as the Speaking (Part – B) starts, the students are asked to resume the Written & Reading (Part – C) and complete within half an hour. The Examiners, both Internal and External shall take 14 (8+6) or 16 (8+8) students of their choice in the batch of 30 candidates. Initially, each Examiner on their part shall call each student one after another to answer to the first four questions (1 to 4), individually within a time span of 50 minutes. Once all the 4 questions are done, the Examiner shall divide them into groups of 6/8 students. Then the examiner can have the group discussion for 5 minutes followed by dialogue in pairs from the group for 3 minutes per pair (4 pairs x 3 minutes = 12 minutes) Then the examiner has the next group of students with whom the examiner conducts the group discussion followed by dialogues in pairs for the same duration. Thus each examiner can finish 16 students in 1 hour 30 minutes, the Part – B Speaking Part.

DURATION: 90 Minutes simultaneously by Each Examiner for 16 students of each set

NOTE: While awarding marks for this SPEAKING (Part – B), the following shall be observed for uniformity in evaluation.

Question 1:

Relevant expression of thought (1 mark for each sentence uttered)

Question 2:

Relevant expressions of Politeness / Courtesy / Etiquette / Mannerism / Request (NOT necessarily each of these but in general 5 Expressions uttered, award 1 mark each)

Questions 3, 4 and 5:

While evaluating each student, the student's Posture, Gestures, Dress code, Pronunciation (2 marks) and Relevance to the content (3 marks) shall be observed and then marks be awarded accordingly.

Question 6: GROUP DISCUSSION

NOTE: The Examiner shall choose a topic from the Question Bank provided in the Syllabus for the group of 6/8 students. The same topic shall not be repeated in any other group or batch.

While assessing and evaluating each of the students in the group, the following are to be observed. Each one's Participation, Confidence in expression, Reacting to the expressed views (assent/refute) amiably and amicably, Relevance to the topic of discussion, Lead and conclude the topic of discussion (1 mark each) may be assessed and marks be awarded accordingly. Thus, a Batch of 30 Students can be examined within 3 hours. Listening 45 minutes, Speaking 90 Minutes, Writing maximum 45 Minutes. (180 Minutes)

Assignment Topics:

III. Guidelines for recording the material on the focused topics in the Record note.

Write in the record note, **on any five topics**, from the list of topics given below. **10 Marks**
(5 topics x 10 marks = 50 marks. Thus, the Average of 5 topics is 10 Marks)

NOTE:

5 students can form a group and choose any 5 topics under the guidance of the English Faculty and Google search and then present them in the class for interaction. Finally they have to be written as Assignments in the Record Note.

Of the 5 topics chosen, 1 topic should compulsorily be taken from the 11th to the 15th topic given below (which are specially the TOPICS ON GENDER SENSITISATION) and the rest of the 4 topics shall be chosen from the 1st to 10th topic given below.

Topics for Assignments:

1. Productivity in Industries – Comparison with developed countries
2. Quality Tools, Quality Circles and Quality Consciousness
3. Effective Management
4. House Keeping in Industries
5. Occupational Safety and Hazard
6. Occupational Accident and First Aid
7. Labour Welfare Legislations
8. Labour Welfare Acts and Rights
9. Entrepreneurship
10. Marketing Analysis, Support and Procurement
11. Important Constitutional and Legal Provisions For Women in India
12. The Harassment of Women at Workplace (Prevention and Prohibition & Redressal) Act, 2013
13. Guidelines and Norms laid down by the Hon'ble Supreme Court in Vishaka and Others
14. The National Commission for Protection of Child Rights (NCPCR)
15. The Protection of Children from Sexual Offences (POCSO) Act & Rule of POCSO Rules, 2012

LIFE AND EMPLOYABILITY SKILLS: QUESTION BANK

A. LISTENING

25 Marks

1.	Listen to the content and take down notes/hints.	10 Marks
2.	Listen to the content and answer the following questions.	10 Marks
3.	Listen to the content and fill in the blanks with the exact words heard.	5 Marks

NOTE: Only Topics related to pollution/environment/global warming are to be taken for listening section. The same Matter/Topic should not however be repeated in the above 3 Listening Activities.

B. SPEAKING

30 Marks

1. Say in a sentence instantly on hearing the word (5 words must be given one after another) **5 Marks**

NOTE: The examiners at the time of Practical Exam may provide Words which are commonly used in day to day life.

2. Say any 5 expressions commonly used in communication. 5 Marks

NOTE: Students are supposed to say 5 expressions reflecting Politeness / Courtesy / Etiquette / Mannerism / Request

3. Introducing Oneself/Others in Organisation. 5 Marks

QUESTIONS:

- Introduce yourself as a prospective candidate for the company while facing the interview.
- Imagine the General Manager from the Head Office of your company has come to inspect your factory. Introduce him.
- Imagine a Consultant has come to your department. Introduce him to your subordinates.
- New Factory Manager has been appointed. Introduce him to all the employees of your firm.
- Introduce yourself after joining the department/factory/company.
- Assume that the Inspector of Factories has come to check the quality of products and the safety standards adopted as per Govt. Norms and Regulations. Introduce him to the staff of all departments for their co- operation, in this regard.
- A Marketing Company Representative visits your factory to buy your product. Introduce him to your Supervisors.

4. Explain/Describe the Product/Machine/Department. 5 Marks

QUESTIONS:

- Explain/Describe the product, you are about to launch in the market.
- Describe the newly installed modern machine in your company which is purchased for the purpose of increasing the production.
- Explain the functioning and the efficiency of the machine that you have manufactured in your company.
- Illustrate the launch of new model car and its capabilities.
- Describe your department

5. Dialogue at the Place of Work. 5 Marks

QUESTIONS:

- As the Department Head, call the Supervisor and talk to him about the installation of the new machines in your factory.
- Talk to your colleague working in the factory about the safety standards to be implemented in your factory after the visit of Inspector of Factories.
- Speak to your colleague about the training you had at the Head Quarters and the outcome of the training in handling the latest machine installed in your factory.
- Call the Subordinate who is irregular and careless in his work. Advise him.
- Speak to your Higher Officer about the steps taken to stop the strike proposed by the workers of your factory.
- Speak with your immediate boss about the progress you have made.

6. Group Discussion 5 Marks

NOTE: Depending on the strength of the students in a Batch, they may be divided into groups of six/eight and be asked to discuss on anyone of the following topics given below.

QUESTIONS:

Discuss within the group on any one of the topics given below.

1. Productivity in Industries – comparison with developed countries
2. Quality Tools, Quality Circles and Quality Consciousness
3. Effective Management
4. House Keeping in Industries
5. Occupational Safety and Hazard
6. Occupational Accident and First- Aid

7. Labour Welfare Legislation
8. Labour Welfare Acts and Rights
9. Entrepreneurship
10. Marketing Analysis, Support and Procurement
11. Global Warming
12. Environment
13. Pollution
14. Importance of Communication in English
15. Constitutional and Legal Provisions for Women in India
16. Harassment of Women at Workplace (Prevention and Prohibition, And Redressal) Act, 2013
17. Guidelines & Norms laid down by Honourable Supreme Court in Vishaka and Others
18. National Commission for Protection of Child Rights (NCPCR)
19. Protection of Children from Sexual Offences Act & Rule 6 of POCSO Rules, 2012

C. WRITING & READING**20 Marks**

1. Frame new questions from the pattern given by changing sets of words with your own.

5 Marks

QUESTION:

When	do	you	return?
How	is	his performance?	
Where	has	the manager	gone?
What	is	the progress	today?
Why	are	the machines	not functioning?

Model answers. (Change of one set is sufficient in each of the sentences)

1. When do you come?
2. Where is his performance?
3. Where has the supervisor gone?
4. How is the progress today?
5. Why are the machines not working?

What	are	the methods	adopted?
When	is	the manager	coming?
Why	will	he	give?
Where	has	the product	gone?
How	do	you	perform?

Why	do	you	go?
Which	has	he	completed?
What	will be	the outcome?	
How	does	this	work?
Where	is	the progress?	

What	would be	the result?	
Whose product	has come out	recently?	
When	shall	the new product	be launched?
How	can we	overcome	this problem?
Who	is	the manager	in this factory?

On Whom	would you	put	the blame?
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Who	shall be	responsible	for this?
What	do you	want to	convey?
When	can we	see	performance?
How	will you	solve	this problem?

When	do	they	award	the winners?
Why	don't	you	realise	your weakness?
Who	will make	him	responsible?	
What	do	you	want	coffee or tea?
Where	can	we	meet	him?

2. Make sentences from the pattern given by changing sets of words with your own. 5 Marks

QUESTION:

The workers	are	on strike.	
The labourers	are paid	well	in this factory.
There	is	a rest room	for the workers.
These	are	the new products	launched.
Almost everyone	came	to the company	on motorbikes.

Model answers. (Change of one set is sufficient in each of the sentences)

1. The engineers are on strike.
2. The labourers are paid less in this factory.
3. There is a rest room for the women staff.
4. These are the new products introduced.
5. No one came to the company on motorbikes.

We	work	for the society.	
They	introduce	new techniques	for efficiency.
Wearing	helmets	is	compulsory.
Our company	announces	bonus	for the employees.
Labour laws	are followed	strictly	in our company

The Supervisor	enquired	the workers.	
The industry	is shut	for May Day.	
New methods	are introduced	in the company.	
Gopi	works	in the first shift.	
We	manufacture	bolts & nuts.	

The workers	are	the assets	of this factory.
The welfare	of the employees	is looked after.	
Safety	is	the first priority	for any company.
Labour welfare laws	are	strictly	followed.
I	take	pride	to work here.

He	was promoted	as G.M	yesterday.
My life	has been	wonderful	here.
These	will be	my targets.	
They	are	in the canteen	now.
We	have	a bike stand	near the gate.

The doctor	is	on duty.	
Edison	was	a great scientist.	

There	were	many trees	in our village.
Our teachers	give	us	useful guidance.
Most children	go	to school	by vans.

3. Prepare a resume.

5 Marks

QUESTIONS:

- Prepare a resume for the post of Department Manager.
- Write a resume for the post of Programme Trainee in a software firm.
- Prepare a resume for the post of Site Supervisor in a Tower Erection company.
- Prepare a resume for the post of Senior Sales Manager, in an organisation.
- Write a resume for the post of Site Engineer in a company.
- Prepare a resume for the post of Lecturer in a Polytechnic College.

4. Prepare an outline of a Project.

5 Marks

QUESTIONS:

- Prepare an outline of a Project to obtain a loan. (Provide only headings and subheadings)
- Prepare an outline of a Project to start a factory with your own funds. (Provide only headings and subheadings)
- Prepare an outline of a Project to start a Retail Selling Showroom with your friends as partners. (Provide headings and subheadings only)
- Prepare an outline of a Project so as to start a factory on Job-work Basis from the order you can get from a big company. (Provide only headings and subheadings)

LIFE AND EMPLOYABILITY SKILLS PRACTICAL

Time: 3 Hours

Maximum Marks: 75

Name:

Date:

Register Number:

Time:

A. LISTENING (25 Marks)	
1. Listen to the content and take down notes/hints	10
2. Listen to the content and answer the following questions.	10
3. Listen to the content and fill in the blanks the exact words heard.	05
B. SPEAKING (30 Marks)	
1. Say in a sentence instantly on hearing the word (5 words, one after another).	05
2. Say any five expressions commonly used in communication.	05
3. Imagine, a consultant has come to your department. Introduce him to your subordinates.	05
4. Explain/describe the product you are about to launch in the market.	05
5. Speak with your immediate boss about the progress you have made.	05
6. Discuss within the group on the topic of focus prescribed in the syllabus.	05

C. WRITING & READING (20 Marks)

1. Frame new questions from the pattern given by changing sets of words with your own.

05

a.	When	do	you	return?
b.	How	is	his performance?	
c.	Where	has	the manager	gone?
d.	What	is	the progress	today?
e.	Why	are	the machines	not functioning?

2. Make sentences from the pattern given by changing sets of words with your own.

05

a.	The workers	are	on strike.		
b.	The labourers	are	well	in this factory.	
c.	There	is	a rest room	for the workers.	
d.	These	are	the new	launched	by our company.
e.	Almost	came	to the company	on motorbikes.	

3. Prepare a resume for the post of Department Manager. 05

4. Prepare an outline of a project to obtain a loan. (Provide headings and subheadings) 05

Signature of the Candidate

DETAILED ALLOCATION OF MARKS: (75 MARKS)

ACTIVITY	MARKS						TOTAL MARKS
PART – A LISTENING	A.1 (10)		A.2 (10)		A.3		
PART – B SPEAKING	B.1 (05)	B.2 (05)	B.3 (05)	B.4 (05)	B.5 (05)	B.6 (05)	
PART – C WRITING & READING	C.1 (05)		C.2 (05)		C.3 (05)		
GRAND TOTAL							

Signature of the Internal Examiner

Signature of the External Examiner

Theory & writing exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

SIXTH SEMESTER

R5-621 INDUSTRIAL ENGINEERING AND MANAGEMENT

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-621 INDUSTRIAL ENGINEERING AND MANAGEMENT	6 Hrs	90 Hrs	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	PLANT ENGINEERING AND PLANT SAFETY	16
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	16
III	PRODUCTION PLANNING AND QUALITY CONTROL	16
IV	PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOR	16
V	FINANCIAL MANAGEMENT AND MATERIAL MANAGEMENT	16
Total Instruction Hours		80

UNIT - I

PLANT ENGINEERING AND PLANT SAFETY

16 Hrs

Plant Engineering: Plant – selection of site of industry – plant layout – principles of a good layout – types – process, product and fixed position – techniques to improve layout – principles of material handling equipment – plant maintenance – importance – break down maintenance, preventive maintenance and scheduled maintenance.

Plant Safety: Importance – accident – causes and cost of an accident – accident proneness – prevention of accidents – Industrial disputes – settlement of industrial disputes – collective bargaining, conciliation, mediation, arbitration – Indian Factories Act 1948 and its provisions related to health, welfare and safety

UNIT - II

WORK STUDY, METHOD STUDY AND WORK MEASUREMENT

16 Hrs

Work Study: Productivity – standard of living – method of improving productivity – objectives – importance of good working conditions

Method Study: Definition – objectives – selection of a job for method study – basic procedure for conduct of method study – tools used – operation process chart, flow process chart, two handed process chart, man machine chart, string diagram and flow diagram

Work Measurement: Definition – basic procedure in making a time study – employees rating factor – application of time allowances – rest, personal, and process, special and policy allowances – calculation of standard time – problems – basic concept of production study – techniques of work measurement – ratio delay study, synthesis from standard data, analytical estimating and Pre-determined Motion Time System (PMTS)

UNIT - III

PRODUCTION PLANNING AND QUALITY CONTROL

16 Hrs

Production Planning and Control: Introduction – major functions of production planning and control – pre planning – methods of forecasting – routing and scheduling – dispatching and controlling – concept of Critical Path Method (CPM) – description only. Production – types – mass production, batch production and job order production – characteristics – Economic Batch Quantity (EBQ) – principles of product and process planning – make or buy decision – problems

Quality Control: Definition – objectives – types of inspection – first piece, floor and centralized inspection – advantages and disadvantages – quality control – statistical quality control – types of measurements – method of variables – method of attributes – uses of X, R, p and c charts – Operating Characteristics curve (O.C curve) – sampling inspection – single and double sampling plan – concept of ISO 9001:2008 Quality Management System registration / certification procedure – benefits of ISO to the organization

UNIT - IV

PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOR

16 Hrs

Principles of Management: Definition of management – Administration – Organization – F.W. Taylor's and Henry Fayol's principles of management – functions of manager – directing – Leadership – styles of leadership – qualities of a good leader – motivation – positive and negative motivation – modern management techniques – Just In Time (JIT) – Total Quality Management (TQM) – Quality Circle (QC) – Zero Defects concept – 5S

Concept – Management Information Systems (MIS) – Strategic Management – SWOT analysis – Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) – Supply Chain Management (SCM) – Activity Based Management (ABM) – global perspective – principles and brief description

Personnel Management: responsibility of human resource management – selection procedure – training of workers – Apprentice training – on the job training and vestibule school training – job evaluation and merit rating – objectives and importance – wages and salary administration – components of wages – wage fixation – type of wage payment – Halsey's 50% plan, Rowan's plan and Emerson's efficiency plan – problems

Organizational Behavior: Definition – organization – types of organization – line, staff, Taylor's pure functional types – line and staff and committee type – organizational approaches – individual behavior – causes – environmental effect – behavior and performance, perception – organizational implications

UNIT - V

FINANCIAL MANAGEMENT AND MATERIAL MANAGEMENT

16 Hrs

Financial Management: Fixed and working capital – resources of capital – shares preference and equity shares – debentures – type of debentures – public deposits, Factory costing: Direct cost – indirect cost – factory overhead – selling price of a product – profit – problems. Depreciation: Causes – methods – straight line, sinking fund and percentage on diminishing value method – problems

Material Management: Objectives of good stock control system – ABC analysis of inventory – procurement and consumption cycle – minimum stock, lead time, reorder level – Economic Order Quantity (EOQ) – problems – supply chain management – Introduction – purchasing procedure – store keeping – bin card

Text Books:

- 1) Industrial Engineering and Management, O.P. Khanna, Ed. 2004, Dhanpat Rai Pub. Co., New Delhi
- 2) Engineering Economics and Management, TR Banga & SC Sharma, McGraw Hill, 2001, New Delhi.

Reference Books:

- 1) Management, A global perspective, Heinz Wehrich, Harold Koontz, 10th Edition, McGraw Hill International Edition 1994.
- 2) Essentials of Management, 4th Edition, Joseph L. Massie, Prentice-Hall of India, New Delhi 2004.
- 3) Principles of Management, M. Govindarajan and S Natarajan, Prentice-Hall of India, New Delhi

Instruction Hours	80 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	90 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-622 COMPUTER AIDED DESIGN AND MANUFACTURING

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-622 COMPUTER AIDED AND MANUFACTURING	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	COMPUTER AIDED DESIGN	13
II	COMPUTER AIDED MANUFACTURING	13
III	CNC PART PROGRAMMING, RAPID PROTO TYPING	13
IV	COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE AND ROBOT	13
V	CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE AND AUGMENTED REALITY	13
Total Instruction Hours		65

UNIT - I**COMPUTER AIDED DESIGN****13 Hrs**

Computer Aided Design: Introduction – CAD definition – Shigley's design process – CAD activities – benefits of CAD. Types of CAD system – Host and terminal based CAD system – PC based CAD system – workstation based CAD system – graphics workstation – CAD software packages. 2D & 3D transformations – translation, scaling, rotation and concatenation

Geometric modeling: Techniques: Wire frame modeling – surface modeling – solid modeling Boundary representation – Constructive Solid Geometry – Comparison

Graphics standard: Definition –Need - GKS – IGES – PHIGS – DXF .Cost involved in design changes – Concept of Design for Excellence (DFX) – Guide lines of Design for Manufacture and assembly (DFMA)

Finite Element Analysis: Introduction – Development – Basic steps – Advantages

UNIT - II**COMPUTER AIDED MANUFACTURING****13 Hrs**

CAM: Definition – functions of CAM – benefits of CAM

Group Technology: Part families – Parts classification and coding – coding structure – Optiz system, MICLASS system and CODE System

Process Planning: CAPP – Types – Variant type, Generative type – advantages of CAPP

Production Planning and Control: computer integrated production management system – Master Production Schedule (MPS) – Capacity planning – Materials Requirement Planning (MRP) – Manufacturing Resources Planning (MRP-II) – Shop floor control system – Just in time manufacturing philosophy – Introduction to enterprises resources planning

UNIT - III**CNC PART PROGRAMMING, RAPID PROTO TYPING****13 Hrs**

CNC PART PROGRAMMING: Manual part programming – coordinate system – Datum points: machine zero, work zero, tool zero – reference points – NC dimensioning – G codes and M codes – linear interpolation and circular interpolation – CNC program procedure – sub-program – canned cycles – stock removal – thread cutting – mirroring – drilling cycle – pocketing.

RAPID PROTOTYPING: Classification – subtractive – additive – advantages and applications – materials. Types – Stereo lithography (STL) – Fused deposition model (FDM) – Selective laser sintering (SLS) – three dimensional printing (3D) – Rapid tooling

UNIT - IV

COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE AND ROBOT 13 Hrs

CIM: Introduction of CIM – concept of CIM – evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM

FMS: Introduction – FMS components – FMS layouts – Types of FMS: Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS – introduction to intelligent manufacturing system

AGV: Introduction – AGV – working principle – types – benefits

ROBOT: Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers – Industrial applications of Robot: Characteristics – material transfer and loading – welding – spray coating – assembly and inspection

UNIT - V

CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE AND AUGMENTED REALITY 13 Hrs

Concurrent Engineering: Definition – Sequential Vs Concurrent engineering – need of CE – benefits of CE

Quality Function Deployment (QFD): Definition – House of Quality (HOQ) – advantages – disadvantages. Steps in Failure Modes and Effects Analysis (FMEA) – Value Engineering (VE) – types of values – identification of poor value areas – techniques – benefits. guidelines of Design for Manufacture and Assembly (DFMA)

Product Development Cycle: Product Life Cycle – New product development processes

Augmented Reality (AR): Introduction – concept – Applications

Text Books:

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

Reference Books :

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

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours

Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-623.1 ELECTIVE THEORY - II WELDING TECHNOLOGY

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-623.1 WELDING TECHNOLOGY	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	WELDING PROCESSES AND EQUIPMENTS	13
II	SPECIAL WELDING PROCESSES	13
III	AUTOMATON AND INNOVATION OF WELDING	13
IV	WELDING METALLURGY AND FERROUS AND NON-FERROUS METAL WELDING	13
V	WELDING ECONOMY, APPLICATIONS AND TESTING	13
Total Instruction Hours		65

UNIT - I WELDING PROCESSES AND EQUIPMENTS

13 Hrs

Introduction to welding – classification of welding and allied process – importance and applications of welding – welding symbols, types of joints and position of welding – types of electrode – selection of electrodes

Arc and Resistance welding – Arc welding power sources – DC Power sources – DC generators – AC, DC rectifiers – AC power sources – generators and transformers – Resistance welding – Spot welding

Gas welding – Oxy-acetylene welding – Gas welding techniques – manipulation and weaving methods – Gas welding equipment – Gas cutting – Brazing – Soldering

Welding safety – safety recommendations for installation and operation of arc welding and cutting equipments – Gas welding and cutting equipments

UNIT - II SPECIAL WELDING PROCESSES

13 Hrs

TIG welding – MIG welding – Submerged arc welding – Electro slag welding – Plasma arc welding – Metal spraying – principle of operation, equipment – merits and demerits – applications

Ultrasonic welding – Explosive welding – Frictional welding – Electron beam welding – Laser beam welding – Thermit welding – under water welding – concept – definition – principle of operation – equipment setup – merits and demerits – applications

UNIT - III

AUTOMATON AND INNOVATION OF WELDING

13 Hrs

Welding sequence and classification of process – Semi automatic – Automatic welding – Automated welding – Automatic welding vs Automated welding – Remote welding – Robotic welding

Introduction of innovation of welding – welding in wind – welding in low ambient temperature – welding in space – narrow gap welding – Gravity welding – welding of plastics – welding of ceramics

UNIT - IV

WELDING METALLURGY AND FERROUS AND NON-FERROUS METAL WELDING

13 Hrs

Concept of weld ability – welding processes for welding wrought iron – welding of cast iron – welding of low carbon steels, high carbon steels – welding of steel castings – welding of alloy steels – welding of stainless steels

Welding of Aluminum and its alloys – Copper and its alloys – Magnesium and its alloys – welding of dissimilar metals

Thermal effects of welding – heat affected zones – grain size control – corrosion of welds – weld decay – dilution

UNIT- V

WELDING ECONOMY, APPLICATIONS AND TESTING

13 Hrs

Principles of sound welding design – economics of welding design – cost of welding design – cost of welding by different processes and selection of welding processes – principles governing design of good welding jigs and fixtures

Defects in welds – causes and remedies – welding distortion – control of welding distortion

Testing of welds – stages of weld inspection and testing – inspection before welding, during welding and after welding – visual inspection – Destructive testing of weld – hardness test, tensile test, bend test, impact test, nick break test, leak test – Non-destructive test, Liquid penetrant, Magnetic particle, Radiography and Ultrasonic inspection – Quality control of welding

Text Books:

1. Welding Processes and Technology - Dr.R.S.Parmar - Khanna Publishers.
2. AWS Welding handbook - Vol I & Vol II

Reference Books:

1. Welding Technology - Richard L.Little - Tata McGraw Hill Publishing Co
2. Advanced Welding Technology - Som Ashutosh – Acme Learning Pvt Ltd

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-623.2 ELECTIVE THEORY - II ROBOTICS

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-623.2 ROBOTICS	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	13
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS	13
III	SENSORS AND MACHINE VISION	13
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	13
V	ROBOT APPLICATIONS IN MANUFACTURING	13
Total Instruction Hours		65

UNIT - I**FUNDAMENTALS OF ROBOT TECHNOLOGY****13 Hrs**

Introduction – definitions – Robot anatomy – basic configuration of Robotics – Robot Components – Manipulator, end effector, driving system, controller and sensors – mechanical arm – degrees of freedom – links and joints – types of joints – joint notation scheme – pitch, yaw, roll – classification of robots – work envelope, work volume – structural characteristics of Robotics – effect of structure on control, work envelop and work volume

UNIT - II**ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS****13 Hrs**

Robot controller – four types of controls – open loop and closed loop controls – speed of response and stability – precision of movements: spatial resolutions, accuracy and repeatability. pneumatic drives – hydraulic drives – mechanical drives – electrical drives – stepper motors, DC servo motors and AC servo motors – salient features – applications and comparisons of drives

End effecters – grippers – mechanical grippers – magnetic grippers – vacuum grippers – two fingered and three fingered grippers – internal and external grippers – End Of Arm Tooling (EOAT) – selection and design considerations

UNIT - III**SENSORS AND MACHINE VISION****13 Hrs**

Requirements of sensors – principles and applications of the following types of sensors – position sensors: Piezo-electric sensors, LVDT, resolvers, optical encoders and pneumatic position sensors – range sensors – proximity sensors: inductive, capacitive,

ultrasonic and optical proximity sensors – touch sensors: binary sensors, analog sensors – wrist sensors – slip sensors
 Machine vision system – camera – frame grabber – sensing and digitizing image data – signal conversion – image storage – lighting techniques – image processing and analysis – data reduction: edge detection, feature extraction and object recognition – applications – inspection, identification, visual serving and navigation

UNIT - IV

ROBOT KINEMATICS AND ROBOT PROGRAMMING

13 Hrs

Forward kinematics, inverse kinematics and differences – forward kinematics and reverse kinematics of manipulators with two, three and four degrees of freedom – deviations – robot programming – teach pendent programming – lead through programming – robot programming languages – VAL Programming – motion commands – sensor commands – end effector commands and simple programs.

UNIT - V

ROBOT APPLICATIONS IN MANUFACTURING

13 Hrs

Robot applications – material handling – press loading and unloading – die-casting – machine tool loading and unloading – spot welding – arc welding – spray painting – assembling – finishing – Automatic Guided Vehicle (AGV) – adopting robots to workstations – requisite robot characteristics and no requisite robot characteristics – stages in selecting robots for industrial applications – safety considerations for robot operations – robotics in the future – economical analysis of robots – social implications

Text Book:

1) "Industrial Robotics – Technology, Programming and Applications", M.P.Groover, MC Graw Hill, 2001

Reference Books:

1) "Robotics Control, Sensing, Vision and Intelligence", Fu.KS.Gonzalez.RC., and Lee CSG, McGraw-Hill Book Co., 1987

2) "Robotics for Engineers", Yoram Koren, McGraw-Hill Book Co., 1992

3) "Robotics and Image Processing", Janakiraman.P.A, Tata McGraw-Hill, 1995

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-623.3 ELECTIVE THEORY - II MECHANICAL INSTRUMENTATION

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
	5 Hrs	75 Hrs	Internal Assessment	External Exam	Total	
R5-623.3 MECHANICAL INSTRUMENTATION			25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit No.	Topics	Hours
I	TYPES OF MEASUREMENT AND MEASUREMENT OF ERROR	13
II	DISPLACEMENT MEASUREMENT AND PRESSURE MEASUREMENT	13
III	TEMPERATURE MEASUREMENT AND FLOW MEASUREMENT	13
IV	MISCELLANEOUS MEASUREMENT	13
V	CONTROL SYSTEMS	13
Total Instruction Hours		65

UNIT - I**TYPES OF MEASUREMENT AND MEASUREMENT OF ERROR****13 Hrs**

Types of measurement: Classification of instruments – static terms and characteristics – range and span – accuracy and precision – reliability – calibration – hysteresis and dead zone – drift – sensitivity – threshold and resolution – repeatability and reproducibility – linearity – dynamic characteristics: Speed of response – fidelity and dynamic errors – overshoot

Measurement of error: Classification of errors – environmental errors – signal transmission errors – observation errors – operational errors

Transducers: Classification of transducers – active and passive – resistive – inductive – capacitive – piezo-resistive – thermo resistive

UNIT - II**DISPLACEMENT MEASUREMENT AND PRESSURE MEASUREMENT****13 Hrs**

Displacement measurement: Capacitive transducer – Potentiometer – LVDT – RVDT – specification – selection & application of displacement transducer – optical measurement scale and encoders

Pressure Measurement: Low pressure gauges – McLeod Gauge – thermal conductivity gauge – Ionization gauge – thermocouple vacuum gauge – Pirani gauge

High pressure gauge: Diaphragm – bellows – bourdon tube – electrical resistance type – photoelectric pressure transducers – piezoelectric type – variable capacitor type

UNIT - III**TEMPERATURE MEASUREMENT AND FLOW MEASUREMENT****13 Hrs**

Non-electrical methods: Bimetal – liquid in glass thermometer and pressure thermometer

Electrical methods: RTD – platinum resistance thermometer – thermistor

Thermoelectric methods: Elements of thermocouple – seebeck series – law of intermediate metals – thermo emf measurement

Flow Measurements: Variable area meter – Rota meter – variable velocity meter – Anemometer – special flow meter – hot wire anemometer – electromagnetic flow meter – ultrasonic flow meter – turbine meter – vortex shedding flow meter

UNIT - IV**MISCELLANEOUS MEASUREMENT****13 Hrs**

Introduction to sound – measurement and study of electro dynamic microphone and Carbon microphone

Humidity measurement: Hair hygrometer – sling psychrometer – liquid level measurement – direct and indirect methods

Force & shaft power measurement: Tool dynamometer (Mechanical Type) – Eddy Current Dynamometer – Strain Gauge Transmission Dynamometer

speed measurement: Eddy current generation type tachometer – incremental and absolute type – mechanical Tachometers – revolution counter & timer – Slipping Clutch Tachometer – Electrical Tachometers – contactless electrical tachometer – inductive pick up – capacitive pick up – Stroboscope

Strain measurement: Stress-strain relation – types of strain gauges – strain gauge materials – resistance strain gauge – bonded and unbonded – types (foil, semiconductor, wire wound gauges) – selection and installation of strain gauges load cells – rosettes

UNIT - V CONTROL SYSTEMS

13 Hrs

Block diagram of automatic control system – closed loop system – open loop system – feedback control system – feed forward control system – servomotor mechanism

Comparison of hydraulic, pneumatic, electronic control systems

Control action: Proportional – Integral – derivative – PI, PD, PID – applications of measurements and control for setup for boilers – air conditioners – motor speed control

Text Books:

1. Mechanical Measurements – Thomas G Beckwith, Roy D Marangani and John H Lienherd- Pearson Publications
2. Mechanical Measurement and Control – D S Kumar, Metropoliton Publications, New Delhi

Reference Books:

1. Engineering Metrology – R.K.Jain, Khanna Publication.
2. Industrial Instrumentation – Al.Sutko, Jerry D Faulk, Delmar Publication

Instruction Hours	65 Hours
Continuous Assessment Test 1, Test 2 & Model Examination	07 Hours
Revision / Assignments / Discussions	03 Hours
Total	75 Hours

*Pattern of the Question paper (Internal and External) - General Pattern (Theory)

R5-624 COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
	Hours / Week	Hours / Sem	Marks			Duration
			Internal Assessment	External Exam	Total	
R5-624 COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL	6 Hrs	90 Hrs	25	75	100	3 Hrs

PART A: SOLID MODELING**40 Hrs****Introduction**

Part modeling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient.

Exercises**3D Drawings**

1. Geneva Wheel
2. Bearing Block
3. Bushed bearing
4. Gib and Cotter joint
5. Screw Jack
6. Connecting Rod

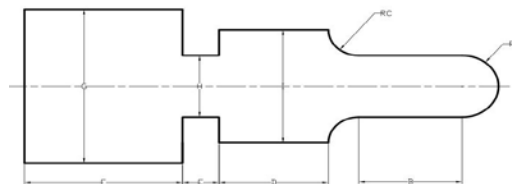
Note: Extract the orthographic view and sectional view from the above assembled 3D drawing.

PART B: CNC Programming**40 Hrs****Introduction:**

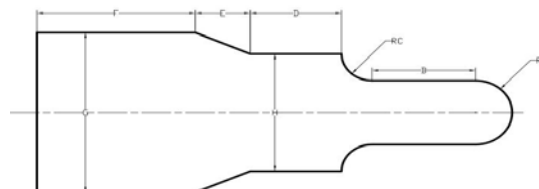
1. Study of CNC lathe, milling
2. Study of international standard codes: G-Codes and M-Codes
3. Format – Dimensioning methods
4. Program writing – Turning simulator – Milling simulator, IS practice – commands – menus

Exercises**CNC Turning Simulation**

1. Create a part program using Linear and Circular interpolation.



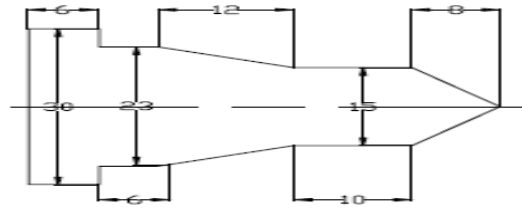
2. Create a part program using stock removal cycle for multiple turning operations.



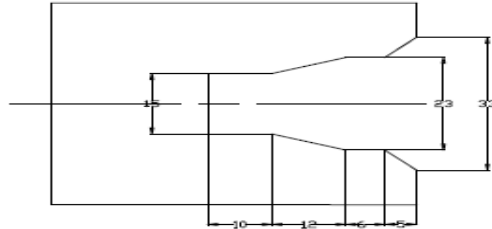
3. Create a part program for thread cutting and grooving using canned cycle.



4. Create a part program for taper turning using box turning cycle.

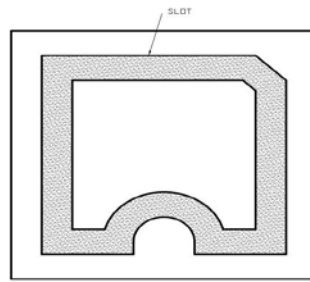


5. Create a part program for internal drill and boring.

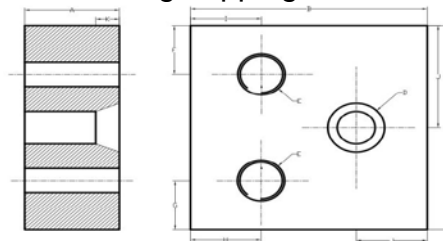


CNC MILLING SIMULATION

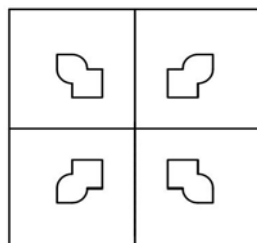
1. Create a part program for grooving using linear interpolation and Circular interpolation.



2. Create a part program for drilling, tapping and counter sinking using canned



3. Create a part program using subprogram.



Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Part – A and one from Part – B. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
PART - A		35 marks
1	Solid modeling	35
PART - B		35 marks
1	CNC program	25
2	Execution / Simulation in the software	10
Viva-voce		05 marks
Total		75 marks

Theory & practical exercises	80 Hours
Revision / Repetition	10 Hours
Total	90 Hours

R5-625 MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-625 MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	

PART - A: MACHINE TOOL ALIGNMENT

Exercises:

1. Conduct the following test for the lathe machine and prepare a test chart.

Check the level of slide ways

Check the straightness of carriage movement

Check the parallelism of tailstock movement to carriage movements

Check the run-out of the spindle

Check the parallelism of the axis of the outside of tailstock sleeve to carriage movement

2. Conduct the following test for the shaping machine and prepare a test chart.

Check the flatness of table top face

Check the parallelism of table top face to its transverse movement

Check the parallelism of table top face to the ram movement

Check the parallelism of T-slot of top face to the ram movement

Check the squareness of table side face to its transverse movement

3. Conduct the following test for the drilling machine and prepare a test chart.

Check the level of the machine

Check the flatness of the table surface

Check the run-out of the internal taper of the spindle

Check the straightness of the pillar and squareness of the spindle axis

Check the squareness of the table surface to the vertical movement of spindle housing

4. Conduct the following test for the surface grinding machine and prepare a test chart.

Verify the leveling of slide ways

Verify the straightness of slide ways in a horizontal plane

Verify the flatness of the table surface

Verify the parallelism of the table surface

Check the run-out of the wheel spindle nose.

5. Conduct the following test for the milling machine and prepare a test chart.

Check the straightness of the vertical movement of the knee

Check the squareness of the table surface to the column ways for knee

Check the flatness of the table surface

Check the parallelism of the table surface to its movement

Check the run-out of the internal taper of the spindle

6. Conduct the following test for the slotting machine and prepare a test chart.

Check the flatness of the table top face

Check the run-out of the central locating bore

Check the parallelism of table surface to its movement in longitudinal direction

Check the squareness of the longitudinal and transverse movements of table

Check the squareness of ram movement to the table surface in the transverse direction

PART - B: MAINTENANCE**Exercises:**

Dismantle, inspect and assemble the following machine components

1. Lead screw and nut
2. Tailstock
3. Bench vice
4. Three jaw chuck
5. Four jaw chuck
6. Drill chuck

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination, one from Machine Tool Alignment and one from Maintenance practical. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Allocation		Max. Marks
Machine Tool Alignment		45 marks (2hours)
1	Procedure / Drawing	15
2	Geometrical test	20
3	Result & Test Chart	10

Maintenance		25 marks (1 hour)
1	Dismantling	10
2	Trouble shooting procedure	10
3	Assembling / Report	05
Viva-voce		05 marks
Total		75 marks

Theory & practical exercises	54 Hours
Revision / Repetition	06 Hours
Total	60 Hours

R5-626.1 ELECTIVE PRACTICAL - II WELDING TECHNOLOGY PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-626.1 WELDING TECHNOLOGY PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Basic Exercises:

1. ARC WELDING

- a. Lap joint (Material: 25 mm x 3 mm M. S. Flat)
- b. Butt Joint (Material: 25 mm x 6 mm M. S. Flat)
- c. Corner Joint (Material: 25 mm x 3 mm M. S. Flat)
- d. T-Joint (Material: 25 mm x 3 mm M. S. Flat)

2 GAS WELDING

- a. Lap joint (Material: 25 mm x 3 mm M. S. Flat)
- b. Butt Joint (Material: 25 mm x 6 mm M. S. Flat)
- c. Corner Joint (Material: 25 mm x 3 mm M. S. Flat)
- d. T-Joint (Material: 25 mm x 3 mm M. S. Flat)

PART A - ADVANCED EXERCISES

1. Making butt and fillet joints by down hand welding (with Single V) using Arc welding
2. Making butt and fillet joints by vertical welding using Arc welding
3. Making fillet weld lap joint by overhead welding using Arc welding
4. Butt welding of thin sheets - leftward, rightward and downward using Gas welding
5. Welding of pipes using Arc welding
6. Welding of tubes using Gas welding
- 7 TIG welding practice – Butt joint
- 8 MIG welding practice – Butt joint

- 9 Spot welding practice in thin sheets
- 10 Submerged arc welding practice – Butt joint
- 11 Making fillet weld T-joint by horizontal welding using Arc welding
- 12 Flash butt welding practice

PART B – THEORY (ARC WELDING AND GAS WELDING)

1. Arc welding equipments and its parts
2. Gas welding equipments and its parts
3. Study of electrode and electrode types, selection of current
4. Types of flames and explanation of welding regulator
5. Types of joint and explanation of edge preparation
6. Study of gas cutting blow pipe
7. Explain defect in arc welding – definition, causes and remedies
8. Inspection of welds (NDT) – visual inspection and method of non destructive test

Examination Pattern:

Note: All the exercises in each section have to be completed. The students are allowed to select the questions by lot as per the allocation. Record notebook should be submitted during the practical examination.

Allocation	Max. Marks
Practical exam (Part A – 2 questions: Arc and Gas welding (1 each))	50 Marks
Written exam (Part B - 2 questions: Arc and Gas welding (1 each))	20 Marks
Viva-voce	05 Marks
Total	75 Marks

Part –A Detailed Allocation		Max. Marks
Arc welding		25 Marks
1	Edge preparation, Job Setting	10
2	Penetration	10
3	Finishing	05
Gas welding		25 Marks
1	Job Setting	10
2	Penetration	10
3	Finishing	05

Basic Exercises (Arc welding and Gas welding)	16 Hours
Advanced Exercises (Arc welding and Gas welding)	24 Hours
Theory (Arc welding and Gas welding)	14 Hours
Revision / Repetition	06 Hours
Total	60 Hours

R5-626.2 ELECTIVE PRACTICAL – II ROBOTICS PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-626.2 ROBOTICS PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

LIST OF EXPERIMENTS:

1. Robot – System connection and component recognition
2. Teaching the Robot using teach pendant using off-line programming
3. Position recording using off-line programming
4. Calculating work space / Work volume using off-line programming
5. Homing operation using on-line and off-line programming
6. Pick and place of object using on-line and off-line programming
7. Pick and stack of the object using on-line and off-line programming
8. Robot performing continuous Arc welding using off-line programming
9. Continuous and intermittent motion using wait command using off-line programming
10. Spray painting using off-line programming
11. Pick & stack the object using subroutine program-on-line and off-line programming
12. Program using X, Y, Z coordinates using off-line programming
13. Teaching position via X, Y, Z coordinates using off-line programming
14. Measurement of Robot motion using on-line and off-line programming
15. Measurement of robot repeatability using on-line and off-line programming

Examination Pattern:

Note: All the exercises in each section have to be completed. Two exercises will be given for examination. The students are allowed to select the questions by lot. Record notebook should be submitted during the practical examination.

Detailed Allocation		Max. Marks
Exercise 1		35 Marks
1	Procedure	05

2	Program	15
3	Execution	15
Exercise 2		35 Marks
1	Procedure	05
2	Program	15
3	Execution	15
Viva-voce		05 Marks
Total		75 Marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-626.3 MECHANICAL INSTRUMENTATION PRACTICAL

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5- 626.3 MECHANICAL INSTRUMENTATION PRACTICAL	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

Exercises:

1. Find the static characteristics of instruments with demonstration of any one measuring instrument
2. Measure displacement by using inductive transducer. (Linear variable displacement transducer i.e. LVDT) and verify its characteristics
3. Measure negative pressure or vacuum using McLeod gauge / Bourdon tube pressure gauge
4. Measure temperature by thermocouple and verifying by thermometer
5. Measure flow of liquid by rotameter
6. Measure liquid level by capacitive transducer system
7. Measure speed of rotating shaft by stroboscope / magnetic / inductive pick up
8. Measure force or weight by load cell
9. Measure strain by using basic strain gauge and verify the stress induced.
10. Measurement of Torque

Examination Pattern:

Note: All the exercises should be given and students are allowed to select an exercise by lot. Record notebook should be submitted during the practical examination.

Detailed Allocation	Max. Marks
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1	Block Diagram	15
2	Reading and graph	35
3	Execution of circuit	20
4	Viva-voce	05
Total		75 Marks

Theory & practical exercises	50 Hours
Revision / Repetition	10 Hours
Total	60 Hours

R5-627 PROJECT WORK

SUBJECT	INSTRUCTIONS		EXAMINATION			
R5-627 PROJECT WORK	Hours / Week	Hours / Sem	Marks			Duration
	4 Hrs	60 Hrs	Internal Assessment	External Exam	Total	
			25	75	100	3 Hrs

ENTREPRENEURSHIP, ENVIRONMENTAL & DISASTER MANAGEMENT

1. ENTREPRENEURSHIP

1.1 Introduction – Entrepreneur – characteristics of Entrepreneur – contributions of an Entrepreneur – functions of entrepreneur – Barriers to entrepreneurship – Roll of government in Entrepreneurial development.

1.2 Small scale industries (SSI) – SSI role in country's economic growth – importance of SSI -starting of an SSI – Government organization and Non-governmental organizations supporting SSI – DIC, NSIC, SIDO, KVIC, Development banks and their objectives – role of commercial banks in assisting SSI – Women entrepreneurs and opportunities – Subsidy and concessions to Small Scale Industries.

2. ENVIRONMENTAL MANAGEMENT

2.1 Introduction – Environmental Ethics – Assessment of Socio Economic Impact – Environmental Audit – Mitigation of adverse impact on Environment – Importance of Pollution Control – Types of Industries and Industrial Pollution.

2.2 Solid waste management – Characteristics of Industrial wastes – Methods of Collection, transfer and disposal of solid wastes – Converting waste to energy – Hazardous waste management Treatment technologies.

2.3 Waste water management – Characteristics of Industrial effluents – Treatment and disposal methods – Pollution of water sources and effects on human health.

2.4 Air pollution management – Sources and effects – Dispersion of air pollutants – Air pollution control methods – Air quality management.

2.5 Noise pollution management – Effects of noise on people – Noise control methods.

3. DISASTER MANAGEMENT

3.1 Introduction – Disasters due to natural calamities such as Earthquake, Rain, Flood, Hurricane, Cyclones etc – Man-made Disasters – Crisis due to fires, accidents, strikes etc – Loss of property and life.

3.2 Disaster Mitigation measures – Causes for major disasters – risk identification – Hazard Zones – selection of sites for Industries and residential buildings – minimum distances from Sea – orientation of buildings – stability of structures – fire escapes in buildings – Cyclone shelters – Warning systems.

3.3 Disaster Management – Preparedness, Response, Recovery – Arrangements to be made in the industries / factories and buildings – Mobilization of Emergency Services – Search and Rescue operations – First Aids – Transportation of affected people – Hospital facilities – Fire fighting arrangements – Communication systems – Restoration of Power supply – Getting assistance of neighbours / other organizations in recovery and rebuilding works – Financial commitments – Compensations to be paid – Insurances – Rehabilitation.

LIST OF QUESTIONS

1. ENTREPRENEURSHIP

1. Define the term Entrepreneur.
2. What is Entrepreneurship? Explain.
3. List the various stages of decisions an entrepreneur has to make before reaching the goal.
4. What is innovation?
5. State briefly the role of an entrepreneur in the economic growth of a country.
6. List the characteristics of an Entrepreneur.
7. What are the critical elements of an Entrepreneur?
8. State the major functions of an Entrepreneur.
9. What are barriers to Entrepreneurship?
10. Define Small Scale Industry.
11. What are the qualities of Entrepreneur?
12. What are the benefits of Entrepreneur?
13. What are the various SSI that can flourish in your district?
14. Identify the infrastructural needs for an industry.
15. What are the various agencies involved in the establishment and development of SSI?
16. Name some of the agencies funding SSI.
17. Explain the roles played by Government in Entrepreneurial development.
18. What are the various concessions and incentives available for a SSI.
19. Name some consumer products with demand that can be manufactured by a SSI?
20. What is feasibility study?
21. What is the importance of SSI?
22. What is DIC? State its functions.
23. What is NSIC? State its functions.
24. What is SIDO? State its functions.
25. Name the Development Banks in India working towards Entrepreneurial development.
26. State the role of commercial bank in assisting SSI sector.
27. What are the different phases of Entrepreneurial Development programme?
28. What is an Industrial Estate?
29. What are the facilities available in an Industrial Estate?
30. Identify the various training agencies associated with SSI.
31. List the govt. agencies from whom you shall get financial assistance for a SSI.
32. What is KVIC? State its objectives.
33. Name some state finance corporations.
34. What are the steps involved in preparing a feasibility report?
35. What are the factors to be considered regarding raw materials for a SSI?
36. What are the features of a SSI?

37. What are the advantages of becoming an Entrepreneur?
38. Name the Organizations offering assistance for the development of Women entrepreneurs.
39. State the business opportunities for Women entrepreneurs.
40. State the different subsidies given to SSI's.

2. ENVIRONMENTAL MANAGEMENT

1. What is the responsibility of an Engineer of an Industry with respect to Public Health?
2. Define Environmental Ethic.
3. How Industries play their role in polluting the environment?
4. What is the necessity of pollution control?
5. List out the different types of pollutions caused by a Chemical / Automobile / Cement factory.
6. What is meant by Hazardous waste?
7. Define Industrial waste management.
8. Differentiate between garbage, rubbish, refuse and trash based on composition and source.
9. Explain briefly how the quantity of solid waste generated in an industry could be reduced.
10. What are the objectives of treatments of solid wastes before disposal?
11. What are the different methods of disposal of solid wastes?
12. Explain how the principle of recycling could be applied in the process of waste minimization.
13. Define the term 'Environmental Waste Audit'.
14. List and discuss the factors pertinent to the selection of landfill site.
15. Explain the purpose of daily cover in a sanitary landfill and state the minimum desirable depth
16. Describe any two methods of converting waste into energy.
17. What actions, a local body such as a municipality could take when the agency appointed for collecting and disposing the solid wastes fails to do the work continuously for number of days?
18. Write a note on Characteristics of hazardous waste.
19. What is the difference between municipal and industrial effluent ?
20. List few of the undesirable parameters / pollutants anticipated in the effluents from oil refinery industry / thermal power plants / textile industries / woolen mills / dye industries / electroplating industries / cement plants / leather industries (any two may be asked)
21. Explain briefly the process of Equalization and Neutralization of waste water of varying characteristics discharged from an Industry.
22. Explain briefly the Physical treatments "Sedimentation" and "Floatation" processes in the waste water treatment.
23. Explain briefly when and how chemical / biological treatments are given to the waste water.
24. List the four common advanced waste water treatment processes and the pollutants they remove.
25. Describe refractory organics and the method used to remove them from the effluent.
26. Explain biological nitrification and de-nitrification.
27. Describe the basic approaches to land treatment of Industrial Effluent.
28. Describe the locations for the ultimate disposal of sludge and the treatment steps needed prior to ultimate disposal.
29. List any five Industries, which act as the major sources for Hazardous Air Pollutants.
30. List out the names of any three hazardous air pollutants and their effects on human health.
31. Explain the influence of moisture, temperature and sunlight on the severity of air pollution effects on materials.
32. Differentiate between acute and chronic health effects from Air pollution.
33. Define the term Acid rain and explain how it occurs.
34. Discuss briefly the causes for global warming and its consequences
35. Suggest suitable Air pollution control devices for a few pollutants and sources.
36. Explain how evaporative emissions and exhaust emissions are commonly controlled.
37. What are the harmful elements present in the automobile smokes? How their presence could be controlled?
38. What is the Advantage of Ozone layer in the atmosphere?
39. Explain the mechanism by which hearing damage occurs.
40. List any five effects of noise other than hearing damage.
41. Explain why impulsive noise is more dangerous than steady state noise.
42. Explain briefly the Source – Path – Receiver concept of Noise control.

43. Where silencers or mufflers are used ? Explain how they reduce the noise.
44. Describe two techniques to protect the receiver from hearing loss when design / redress for noise control fail.
45. What are the problems faced by the people residing along the side of a railway track and near to an Airport? What provisions could be made in their houses to reduce the problem?

3. DISASTER MANAGEMENT

1. What is meant by Disaster Management? What are the different stages of Disaster management?
2. Differentiate Natural Disasters and Man made Disasters with examples.
3. Describe the necessity of Risk identification and Assessment Surveys while planning a project.
4. What is Disasters recovery and what does it mean to an Industry?
5. What are the factors to be considered while planning the rebuilding works after a major disaster due to flood / cyclone / earthquake? (Any one may be asked)
6. List out the public emergency services available in the state, which could be approached for help during a natural disaster.
7. Specify the role played by an Engineer in the process of Disaster management.
8. What is the cause for Earthquakes? How they are measured? Which parts of India are more vulnerable for frequent earthquakes?
9. What was the cause for the Tsunami 2004 which inflicted heavy loss to life and property along the coast of Tamilnadu ? Specify its epicenter and magnitude.
10. Specify the Earthquake Hazard Zones in which the following towns of Tamilnadu like: (a) Chennai (b) Nagapattinam (c) Coimbatore (d) Madurai (e) Salem.
11. Which parts of India are experiencing frequent natural calamities such as (a) heavy rain fall (b) huge losses due to floods (c) severe cyclones
12. Define basic wind speed. What will be the peak wind speed in (a) Very high damage risk zone – A, (b) High damage risk zone, (c) Low damage risk zone.
13. Specify the minimum distance from the Sea shore and minimum height above the mean sea level, desirable for the location of buildings.
14. Explain how the topography of the site plays a role in the disasters caused by floods and cyclones.
15. Explain how the shape and orientation of buildings could reduce the damages due to cyclones.
16. What is a cyclone shelter? When and where it is provided? What are its requirements?
17. What Precautionary measures have to be taken by the authorities before opening a dam for discharging the excess water into a canal/river?
18. What are the causes for fire accidents? Specify the remedial measures to be taken in buildings to avoid fire accidents.
19. What is a fire escape in multistoried buildings? What are its requirements?
20. How the inmates of a multistory building are to be evacuated in the event of a fire/Chemical spill/Toxic Air Situation/ Terrorist attack, (any one may be asked).
21. Describe different fire fighting arrangements to be provided in an Industry.
22. Explain the necessity of disaster warning systems in Industries.
23. Explain how rescue operations have to be carried out in the case of collapse of buildings due to earthquake / blast / Cyclone / flood.
24. What are the necessary steps to be taken to avoid dangerous epidemics after a flood disaster?
25. What relief works that have to be carried out to save the lives of workers when the factory area is suddenly affected by a dangerous gas leak / sudden flooding?
26. What are the difficulties faced by an Industry when there is a sudden power failure? How such a situation could be managed?
27. What are the difficulties faced by the Management when there is a group clash between the workers? How such a situation could be managed?
28. What will be the problems faced by the management of an Industry when a worker dies because of the failure of a mechanical device due to poor maintenance? How-to manage such a situation ?

29. What precautionary measures have to be taken to avoid accidents to labourers in the Industry in a workshop / during handling of dangerous Chemicals / during construction of buildings / during the building maintenance works.
30. Explain the necessity of medical care facilities in an Industry / Project site.
31. Explain the necessity of proper training to the employees of Industries dealing with hazardous products, to act during disasters.
32. What type of disaster is expected in coal mines, cotton mills, Oil refineries, ship yards and gas plants?
33. What is meant by Emergency Plan Rehearsal? What are the advantages of such Rehearsals?
34. What action you will take when your employees could not reach the factory site because of continuous strike by Public Transport workers?
35. What immediate actions you will initiate when the quarters of your factory workers are suddenly flooded due to the breach in a nearby lake / dam, during heavy rain?
36. What steps you will take to avoid a break down when the workers union of your Industry have given a strike notice?
37. List out few possible crisis in an organization caused by its workers? What could be the part of the middle level officials in managing such crisis?
38. What types of warning systems are available to alert the people in the case of predicted disasters, such as floods, cyclone etc.
39. Explain the necessity of Team work in the crisis management in an Industry / Local body.
40. What factors are to be considered while fixing compensation to the workers in the case of severe accidents causing disability / death to them?
41. Explain the legal / financial problems the management has to face if safety measures taken by them are found to be inadequate.
42. Describe the importance of insurance to men and machinery of an Industry dealing with dangerous jobs.
43. What precautions have to be taken while storing explosives in a match/ fire crackers factory?
44. What are the arrangements required for emergency rescue works in the case of Atomic Power Plants?
45. Why residential quarters are not constructed nearer to Atomic Power Plants?

Examination Pattern:

Internal Assessment:

The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Details of assessment	Period of assessment	Max. Marks
First Review	06 th week	10
Second Review	12 th week	10
Attendance	Entire semester	05
Total		25

End Semester Exam:

Details of Mark Allocation	Max Marks
Report Preparation, Demo, Viva-voce	60 Marks
4 questions from each topic in question bank consisting of Entrepreneurship, Environmental Management and Disaster Management will be asked. Out of four questions the students have to write any two questions from each topic. 2 questions x 3 topics = 6 questions (6 x 2 ½ = 15 Marks)	15 Marks
Total	75 Marks

A neatly prepared PROJECT REPORT in the following format has to be submitted individually during the Project Work & Viva-voce Autonomous examination.

FORMAT FOR PREPARATION OF PROJECT REPORT

1. ARRANGEMENT OF CONTENTS:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Bonafide Certificate
3. Abstract
4. Table of Contents
5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations and Nomenclature
8. Chapters
9. Appendices
10. References

The table and figures shall be introduced in the appropriate places.

2. PAGE DIMENSION AND BINDING SPECIFICATIONS:

The dimension of the project report should be in A4 size. The project report should be bound using flexible cover of the thick white art paper. The cover should be printed in black letters and the text for printing should be identical.

3. PREPARATION FORMAT:

- 3.1 Cover Page & Title Page:** A specimen copy of the Cover page & Title Page and Bonafide Certificate of the project report will be given in Appendix - I and Appendix - II.
- 3.2 Bonafide Certificate:** The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14. The certificate shall carry the Guide's signature and shall be followed by the guide's name, Academic designation (not any other responsibilities of administrative nature), Department and full address of the Institution. The term 'GUIDE' must be typed in capital letters between the Guide's name and academic designation.
- 3.3 Abstract:** Abstract should be one page synopsis of the project report typed in double line spacing, Font Style Times New Roman and Font Size 14.
- 3.4 Table of Contents:** The table of contents should list all material following it as well as any material which precedes it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents but the page numbers of which are in lower case Roman letters. One and a half spacing should be adopted for typing the matter under this head.

3.5 List of Tables: The list should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

3.6 List of Figures: The list should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

3.7 List of Symbols, Abbreviations and Nomenclature: One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

3.8 Chapters: The chapters may be broadly divided into 3 parts

(I) Introductory chapter

(II) Chapters developing the main theme of the project work such as

1. Objectives
2. Collection of data and required survey work
3. Management and construction procedure
4. Resources scheduling and networking
5. Design details
6. Required drawing set
7. Utility to society if any, and

(III) Conclusion.

The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions. Each chapter should be given an appropriate title.

Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.

Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page, which refers to the material they annotate.

3.9 Appendices: Appendices are provided to give supplementary information, which is included in the main text may serve as a distraction and cloud the central theme.

- Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc.
- Appendices, Tables and References appearing in appendices should be numbered and referred to at appropriate places just as in the case of chapters.
- Appendices shall carry the title of the work reported and the same title shall be made in the contents page also

3.10 Table and figures: By the word Table, is meant tabulated numerical data in the body of the project report as well as in the Appendices. All other non-verbal materials used in the body of the project work and appendices such as charts, graphs, maps, photographs and diagrams may be designated as figures.

3.11 List of References: The listing of references should be typed 4 spaces below the heading “REFERENCES” in alphabetical order in single spacing left-justified. The reference material should be listed in the alphabetical order of the first author. The name of the author / authors should be immediately followed by the year and other details.

Eg: 1. Neville, A. M., Concrete Technology, Fourth edition, Pearson Education, New Delhi.

4. TYPING INSTRUCTIONS:

The impression on the typed copies should be black in colour. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style 'Times New Roman' and Font size 12.

APPENDIX - I

(A typical Specimen of Cover Page & Title Page)

TITLE OF PROJECT REPORT

<1.5 line spacing>

A PROJECT REPORT

Submitted by

<Italic>

NAME OF THE CANDIDATE(S)

*Submitted for partial fulfillment of requirement for the award of the Diploma
in*

<1.5 line spacing><Italic>

BRANCH OF STUDY



SRI RAMAKRISHNA MISSION VIDYALAYA POLYTECHNIC COLLEGE

<1.5 line spacing>

(AN AUTONOMOUS & ISO 9001:2008 CERTIFIED INSTITUTION)

Sri Ramakrishna Vidyalaya Post, Coimbatore – 641 020

☎ 0422-2692432 ♦ E-mail: srkvtech56@gmail.com

Fax: (0422) 2692582 ♦ Website: www.srkv.org

MONTH & YEAR

APPENDIX - II

(A typical specimen of Bonafide Certificate)

**SRI RAMAKRISHNA MISSION
VIDYALAYA POLYTECHNIC COLLEGE
COIMBATORE – 641 020**

BONAFIDE CERTIFICATE

Certified that this project report entitled “.....**TITLE OF THE PROJECT.....**” is the bonafide work done by “.....**NAME OF THE CANDIDATE.....**” with his batch-mates, in partial fulfillment of the requirement for the award of Diploma in **BRANCH OF STUDY.....** under my guidance.

<<Signature of the Head of the Department>>

<<Signature of the Guide>>

SIGNATURE

<<Name>>

HEAD OF THE DEPARTMENT

<<Academic Designation>>

<<Department>>

SIGNATURE

<<Name>>

GUIDE

<<Academic Designation>>

<<Department>>

Submitted for Autonomous Examination held on

INTERNAL EXAMINER

EXTERNAL EXAMINER