

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

**PROGRAMME : DIPLOMA IN CE ,ME, EE,EC, MC,IT, CM, MT,PK,
AE, TX, AI**

COURSE CATEGORY: BASIC SCIENCE COURSE

COURSE CODE : PH101G

COURSE TITLE : PHYSICS

TEACHING SCHEME: TH:03; TU: 00;PR: 02(CLOCK HRs.)

TOTAL CREDITS : 04(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE EXAM : 03 HRs

PR. TEE EXAM : 02 HRs

PT. EXAM : 01 HR

❖ RATIONALE:

Physics is a fundamental science that endeavors to explain all the natural phenomena that occur in the universe. Studying physics will enable students to become citizens who are better informed about the world around them and who have the critical skills to evaluate and make evidence-based decisions about current scientific issues. The subject will also provide a foundation in physics knowledge, understanding and skills for those students who wish to pursue tertiary study in engineering and technology.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Determine various physical quantities of matter using various measuring instrument.
2. Apply the laws and principles of electricity and magnetism to solve engineering problems.
3. Use the basic principles of heat and optics for engineering applications

4. Apply principles of wave motion, acoustics and radioactivity for engineering problems.
5. Apply the basic physical concepts and terminology used in modern physics.
6. Identify nanotechnology and non-destructive testing for various applications in engineering.

❖ **COURSE DETAILS:**

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs .
1. General Properties of Matter	1a. Describe the given types of modules of elasticity. 1b. Identify least count and range of given instruments. 1c. Illustrate the phenomenon of Capillarity and angle of contact of for given liquid . 1d. Find given physical quantities using laws of viscosity .	1.1 Elasticity, Plasticity, Rigidity. Stress and Strain with their types, Elastic Limit, Hook's Law, Types of modulus of Elasticity, Stress-Strain curve, Applications of elasticity, calculation of the value of Young's modulus of elasticity of given wire . 1.2 Least count and range of instruments: Vernier caliper, outside micrometer screw gauge, travelling microscope. 1.3 Surface Tension, Factors affecting surface tension, Molecular force, cohesive and adhesive force, Angle of contact with its significance and capillary action (formula only), Application, determination of rise of liquid in capillary tube and surface tension of liquid. 1.4 Viscous force, Definition of viscosity, Newton's law of viscosity, Stoke's law, statement and formula only, Coefficient of viscosity and S.I. unit. Types of flow of liquid, Application, calculation of Reynold's number, terminal velocity and coefficient of viscosity of given fluids.	06
2. Electricity, Magnetism and	2a. Apply Coulomb's inverse square law for determining the force between different	2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference.	08

Semiconductors	charges on given data. 2b. Describe given concepts of magnetism. 2c. Determine given parameters in electricity using Ohm's law. 2d. Differentiate materials on the basis of given energy band diagram. 2e. Describe the given biasing and its characteristics of PN junction diode.	2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux. 2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, heating effecting of electric current, calculation of resultant resistance of given resistances in series and parallel combination. 2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors. 2.5 p-n junction diode, I-V characteristics of p-n junction, applications of p-n junction diode.	
3. Heat and Fiber Optics	3a. Select the modes of transmission of heat for given materials. 3b. Illustrate the given laws related to gas and specific heat. 3c. Describe the given phenomenon of light.	3.1 Heat: Three modes of transmission of heat. Good and bad conductor of heat with examples, Law of thermal conductivity and S.I. units. 3.2 Boyles' law, Charles' law, Gay Lussac's law, absolute zero temperature, General gas equation (statement only), two specific heats of gases, adiabatic index. 3.3 Reflection, Refraction, Snell's law, Optical fiber, Structure of optical fiber. Principle of Optical fiber-total internal reflection. Acceptance angle, Numerical aperture. Applications of Optical Fiber.	10
4. Wave Motion and Radioactivity	4a. Classify the given types of wave by their characteristics. 4b. Calculate velocity of sound with end correction on given data. 4c. Find given terms related to Acoustics. 4d. Calculate half-life period of given radioactive substance.	4.1 Definition of wave motion, amplitude, period, frequency & wavelength, relation between velocity, frequency & wavelength. Progressive wave, Stationary waves, longitudinal and transverse wave. Node, Antinode. 4.2 Definition of resonance with example. Formula for velocity of sound with end correction, calculation of velocity of sound with the help of resonance tube. 4.3 Echo, Reverberation, Reverberation Time. Absorption coefficient of	08

		material, Sabine's formula, Factors affecting the Reverberation of time and acoustics of building. Sound absorbing materials, calculation of reverberation time by Sabin's formula. 4.4 Radioactivity, α, β and γ rays and their Properties. Radioactive decay law, half- life period, Advantages and disadvantages of Radioactivity.	
5. Modern Physics (Photoelectricity, LASER, X-Rays)	5a. Calculate given parameters of the photo electricity using given wavelength or frequency. 5b. Apply the basic concepts of LASER in given fields. 5c. Describe the production of X-rays of the given materials with properties and applications.	5.1 Photon, properties of photons, Planck's hypothesis, Threshold frequency, threshold wavelength and Stopping potential. Work function, Photoelectric effect with characteristics properties. Principle, Construction and working of Photoelectric cell with applications. Einstein's photoelectric equation. (Numerical based on above) 5.2 Properties of laser, Types of laser, absorption, spontaneous and stimulated emission. Definition of Pumping and its type, Population inversion, Metastable state. Applications of LASER in Engineering and biomedical field. 5.3 Introduction to X-rays, Properties of X-rays, production of X-ray using Coolidge tube. Applications of X-rays in Engineering, medical and scientific field.	12
6. Nanotechnology and Non Destructive Testing.	6a. Calculate surface area per volume ratio of given objects. 6b. Compare DT and NDT methods on the basis of given points.	6.1 Definition of nanoscale, nanometer, nanoparticle, determination of surface area per volume ratio of objects, application of nanotechnology in Engineering and Technology, medical, cosmetics, environmental, space and defence. 6.2 Non Destructive Testing (NDT), comparison of DT and NDT, Various NDT methods used, Criteria for the selection of NDT method, Merits and Demerits of	04

		NDT.	
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify the various instruments used in Physics laboratory and follow precautionary measures.	General Properties of Matter	02
2	Measure the outer diameter of a cylindrical body by Vernier Caliper.		02
3	Calculate the diameter of a small spherical body by Outside micrometer screw gauge.		02
4	Calculate the value of Young's modulus of elasticity of given wire .		02
5	Find rise of liquid in capillary tube and compute surface tension of liquid.		02
6	Determine the coefficient of viscosity of given fluids by Stoke's method		02
7	Calculate mechanical equivalent of heat, J by electrical method.	Electricity, Magnetism and Semiconductor	02
8	Use magnetic compass to draw the magnetic lines of forces of bar magnet		02
9	Calculate the resultant resistance of given resistances in series and parallel combination.		04
10	Analyze the effect of volume on pressure at constant temperature.	Heat, Gas Laws and Fibre Optics	02
11	Determine inner diameter of resonance tube using Vernier Caliper.	Wave Motion and Radioactivity	02
12	Find the velocity of sound with the help of resonance tube.		04
13	Find the divergence of Laser beam.	Modern Physics	02
14	Calculate the surface area (SA), volume (V) and SA/V of an object and measure dimensions required for it.	Nanotechnology and Non Destructive Testing	02
		Total hours	32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	General Properties of Matter	02(04)	06(00)	00(00)	08(04)
2	Electricity, Magnetism and Semiconductor	02(00)	06(06)	03(00)	11(06)
3	Heat, Gas Laws and Fiber Optics	02(00)	06(00)	03(06)	11(06)
4	Wave Motion and Radioactivity	02(02)	03(06)	06(00)	11(08)
5	Modern Physics	02(00)	06(03)	06(06)	14(09)
6	Nanotechnology and Non Destructive Testing	02(00)	03(03)	00(00)	05(03)
	Total	12(06)	30(18)	18(12)	60(36)

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

L- Level of Question

M- Marks

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

[illegible]

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Who m	Frequency	Max Mark s	Min Mark s	Evidence Collected	Course Outcome s
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignment s		Assignment s	15	--	Assignmen t Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5, 6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignment s	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Practical Answer Scripts	1,2,3,4,5, 6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	-	-	3	-	-	3	-	-	-
2	3	-	-	-	2	-	3	-	-	-
3	3	-	-	-	-	-	3	-	-	-
4	3	-	-	3	-	-	3	-	-	-
5	3	-	-	-	2	-	3	-	-	-
6	3	-	-	3	-	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Modern Physics	B.L.Thereja, S.Chand & Company Ltd 5 th Edition, 2014	13:978-8-12-190163-5
2	Engineering Physics	V.Rajendran, The McGraw Hill Education Pvt. Ltd, 1 st Edition, 2010	13: 978-0-07-107014-0
3	Conceptual Physics	P.G.Hewitt, San Francisco Addison Wesley- 10 th Edition, 2006	13: 9780321909107
4	Engineering Physics	R.K.Gaur and S.L.Gupta, Dhanpatrai Publication New Delhi, 1987	97-8-18-992822-3

❖ **E-REFERENCES:**

- <https://www.britannica.com/science/viscosity>, accessed on 21 June 2021.
- <https://www.livescience.com/58816-photoelectric-effect.html>, accessed on 19 June 2021.

- <https://www.livescience.com/58816-photoelectric-effect.html>, accessed on 19 June 2021.
- <https://www2.lbl.gov/abc/wallchart/chapters/03/4.html>, accessed on 19 June 2021.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Vernier Caliper (Least count= 0.01 cm and range= 0 to 12 cm)
2. Screw gauge (Least count= 0.001 cm and range= 0 to 2.5 cm)
3. Young's Modulus- Searle's apparatus with micrometer reading 0.001 cm.
4. Travelling microscope (vertical and horizontal scales with range 0- 15 cm with least count 0.001 cm)
5. Resonance apparatus with glass tube and metal reservoir (L= 0- 100 cm)
6. Tuning fork -256, 320, 384, 428, 480, 512 Hz.
7. Boyle's apparatus iron base double steel rod, 25 ml fitted with leveling screw on base
8. Stoke's apparatus with glass tube 50 cm.
9. Stop watch GEM 1/10 sec.
10. Ammeter (DC, 0-5 Amp)
11. Millimeter (DC, 0-1 Amp. G.E. type D 50)
12. Voltmeter (DC, 0-3V)
13. Rheostat single tube of 6.5 cm dia., 30 cm length, 5 Amp, 18 ohm, provided with Bakelite solidier with phosphor, bronze contacts.
14. Joule's calorimeter with mass 198 cal/gms.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.S.B.Raut	Lecturer	Government Polytechnic, Nagpur.
2	Mrs.S.B.Adulkar	Lecturer	Government Polytechnic, Nagpur.
3	Dr.A.R.Karule	Lecturer	Government Polytechnic, Nagpur.
4	Dr.N.V.Pradnyakar	Associate Professor	J D College of Engineering and Technology, Nagpur
5	Dr.V.B.Pawade	Assistant Professor	Laxminarayan Institute of Technology, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

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COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/AE/PK/MT/EE/EC/IT/CM/TX/
MC/AI

COURSE CATEGORY: BASIC SCIENCE COURSE

COURSE CODE : MH101G

COURSE TITLE : BASIC MATHEMATICS

TEACHING SCHEME: TH:03; TU: 01(1TH/TU CREDIT=1CLOCK HRS.)

TOTAL CREDITS : 04

TH. TEE : 03 HRs

PR. TEE : --

PT. : 01 HR

❖ RATIONALE:

The course is classified under basic sciences and intends to teach students basic facts, concepts and principles of Mathematics as a tool to analyze Engineering problems. Mathematics lay- down the foundation for understanding core Technology courses.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply laws of logarithm to solve engineering problems.
2. Resolve Proper real fractions into partial fractions.
3. Apply matrix method to solve simultaneous equations in two and three variables.
4. Use concept of allied angle, compound angle, multiple, and sub multiple angle to solve engineering problems.
5. Find principle value of inverse trigonometric functions, use properties to solve the examples of inverse trigonometric functions.
6. Use measures of central tendency and measures of dispersion in decision making.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Logarithm	1a. Evaluate the value of given logarithm without using calculator. 1b. Solve the given logarithm by using Laws of logarithm. 1c. Identify natural and common logarithm.	1.1 Logarithm:-Concept of Logarithm 1.2 Rules and Laws of Logarithm; Addition, Subtraction, Multiplication, Division and Change of Base Formula. 1.3 Concept of natural & common logarithm	03
2. Partial Fractions	2a. Identify rational function, proper and improper fraction. 2b. Resolve the given proper fraction into partial fraction. 2c. Resolve the given improper fraction into partial fraction.	2.1 Concept of rational function , proper ,improper fraction and partial fraction 2.2 Resolving proper fraction into partial fraction. Denominator containing non repeated linear factors, Denominator containing repeated linear factors, Denominator containing irreducible non repeated quadratic factors 2.3 Resolving improper fraction into partial fraction.	05
3. Determinant and Matrix	3a. Find the value of given determinant of order 2 and 3. 3b. Solve the given matrix by using Algebra of matrix, transpose of matrix , ad-joint of matrix, singularity of matrix and find inverse of matrix. 3c. Solve the given simultaneous equation in two and three variables.	3.1 Concept of determinant ,order of determinant, Expansion & Evaluation of determinant of order 2 and 3 3.2 Concept of matrix, Types of matrices, Algebra of matrices Transpose of matrix , ad-joint, singularity of matrix and inverse of matrix 3.3 Solution of system of linear equations two and three variables by inverse matrix method	12
4. Trigonometry	4a. Use fundamental identities to solve the given Trigonometric relation. 4b. Apply the concept of allied angle , compound angle, multiple angle (2θ and 3θ) sub-multiple angle ($\frac{\theta}{2}$), to solve the given trigonometric relation. 4c. Apply Factorisation, De-	4.1 Fundamental identities, Trigonometric ratios of any angle. 4.2 Trigonometric ratios of allied angles, compound angles , multiple and sub-multiple angles (without proof) 4.3 Factorization and de-factorization formulae(without proof).	14

	Factorisation formulae to solve the given trigonometric relations.		
5. Inverse Trigonometric Functions	5a. Find the principle value the given Inverse trigonometric functions. 5b. Solve the given inverse trigonometric functions. 5c. Evaluate the value of given inverse trigonometric functions.	5.1 Concept of inverse trigonometric functions, Principle values of inverse trigonometric functions. 5.2 Properties of inverse trigonometric functions. 5.3 Relation between inverse trigonometric functions	05
6. Statistics	6a. Find mean or Combined Mean of given Statistical data. 6b. Find the Range, Co-efficient of Range, Mean Deviation, Standard Deviation of given Statistical data. 6c. Find variances, coefficient of variation of given Statistical data. 6d. Compare the given Two sets and Check the Consistency & Reliability OR Interpret the result by co-efficient of variations.	6.1 Measures of central tendency Mean (only), & Combined mean 6.2 Measures of dispersion:- Range, mean deviation, standard deviation of Discrete, Grouped & Ungrouped Data. 6.3 Variance and coefficient of variation, of Discrete, Grouped & Ungrouped Data. 6.4 Comparison of two sets of observations, Consistency & Reliability	09
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assignments	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Solve examples using laws of logarithm.	Logarithm	01
2	Find partial fraction of proper fraction.	Partial fraction	01
3	Find partial fraction of improper fraction.		01
4	Expand determinant of order 2 and 3.	Determinant and Matrix	01
5	Perform all algebraic operations on matrices.		01
6	Find transpose, ad-joint and inverse of matrix.		01
7	Solve simultaneous equations in two and three variables.		01
8	Verify trigonometric identities.	Trigonometry	01
9	Use allied angle and compound formulae.		01
10	Use multiple and sub-multiple angle formulae.		01
11	Apply factorization formula to solve examples.		01
12	Apply de-factorization formula to solve examples.		01
13	Find principle values of inverse trigonometric functions and verify formulae.	Inverse trigonometric functions	01

14	Find mean of any data and combined mean of two sets of data.	Statistics	01
15	Find the range, mean deviation, standard deviation and variance.		01
16	Find coefficient of variation and compare the consistency.		01
Total Hrs.			16

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Logarithm	04(00)	00(00)	00(03)	04(03)
2	Partial Fraction	00(04)	03(00)	03(00)	06(04)
3	Determinant and Matrix	02(02)	06(03)	06(03)	14(08)
4	Trigonometry	02(00)	12(06)	06(06)	20(12)
5	Inverse Trigonometric Functions	02(00)	00(03)	03(00)	05(03)
6	Statistics	02(00)	03(03)	06(03)	11(06)
	Total	12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	1	R	2	2	R	2	2	R	2	3	R	2	3	R	2	6/9
	4	R	2	5	R	2	6	R	2										
2	2	U	3	3	U	3	3	U	3	1	A	3	2	A	3				3/5
3	3	U	3	4	U	3	4	U	3	4	U	3	3	A	3				3/5
4	4	U	3	4	U	3	4	U	3	4	A	3	4	A	3				3/5
5	5	U	3	6	U	3	6	U	3	5	A	3	6	A	3				3/5
6	3	A	6	4	A	6	6	A	6										2/3

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Who m	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcome s
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Sheets	1, 2, 3, 4,5,6
		Class Room Assignment s		Tutorial Assignments	15	--	Assignme nt Book	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Stude nts	End of the Course	60	24	Theory Answer Sheets	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	--	--	--	--
		Journal Writing		Assignments	--	--	--	--
				Total	--	--		
	TEE (Term End Examination)	End Exam	Stude nts	End of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Stude nts	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
	Nil	

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	-	-	-	-	-	-			
2	3	-	-	-	-	-	-			
3	3	-	-	-	-	-	3			
4	3	-	-	-	-	-	-			
5	3	-	-	-	-	-	-			
6	3	-	-	-	-	1	3			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Higher Algebra	Hall & Knight, Publisher: Arihant, 6 th Edition 2021	9789351762539
2	Plane Trigonometry	S.L.Loney, Publisher: Arihant, 5 th Edition 2015	9352030540
3	Basic Statistics	B.L. Agarwal, Publisher: Anshan	1848290675
4	Basic Mathematics	G.V. Kumbhojkar, P. Jamnadas LLP., 21 st Edition 2017	978-81-934573-5-1
5	Fundamental of Statistics	S.C. Gupta, Himalaya Publishing House, 7 th Edition 2015	9789350517697

❖ **E-REFERENCES:**

- https://econtent.msbte.ac.in/econtent/econtent_home.php
- <https://www.khanacademy.org>
- https://www.youtube.com/watch?v=5_TuK1yCPD4

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Mr.S.M.Sayyed	I/C Mathematics Dept.	Govt. Polytechnic Nagpur
2	Mr.P.T.Khobragade	Lecturer	Govt. Polytechnic Nagpur
3	Mr.G.R.Dewalkar	Lecturer	Govt. Polytechnic Sakoli
4	Dr.P.B.Bahatkar	Professor	Y. C. C. E. Nagpur
5	Mr.W.T.Gaidhane	Lecturer	Nagar Parishad Junior College, Arvi

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN AI,CE,ME,EE,EC,PK,MC,MT,IT,AU,CM,
TX,TR

COURSE CATEGORY : HUMANITIES & SOCIAL SCIENCE COURSE

COURSE CODE : EN101G

COURSE TITLE : ENGLISH

TEACHING SCHEME : TH: 02 TU: 00; PR: 02 (CLOCK HRs.)

TOTAL CREDITS : 03(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE : 02 HRs

PR. TEE : 02 HRs

PT. : 01 HR

❖ RATIONALE:

English as a means of communication and interaction is imperative in the holistic development of an individual. While giving a practical view of the world around him it also helps define well their role in the world. While teaching this course, emphasis will be laid on enhancing expression of ideas in English by the students. Excellence in this language enables a professional to develop his career as well as builds a strong standing in society.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Incorporate Grammatically correct structures in usage.
2. Acquire comprehension ability.
3. Assess the idea and information given.
4. Demonstrate usage of language effectively.
5. Formulate language into meaningful structures.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Application of Grammar	1a. Incorporate correct sentence pattern in writing and speaking. 1b. Identify & use tenses in various situation. 1c. Formulate direct and indirect speeches according to the situations. 1d. Draft multiple and meaningful sentences	1.1 Articles & Prepositions 1.2 Tenses: Appropriate uses of tenses in given situations. 1.3 Voice: use of active and passive voice. 1.4 Narration: direct & indirect speech	06
2. Text	2a. Interpret oral summary of topics read or heard. 2b. Adjust speed of reading. 2c. Follow oral instructions and explain them to others. 2d. Comprehend the lecture and make notes while listening. 2e. Inculcate ethical and inspirational values	2.1 Text: Learning to read fluently and to develop insight through. Selected prose prescribed in the text. 1. Dale Carnegie's : Six ways to make people like you 2. When Life gave me Lemons- Rashmi Raj 3. Two Gentlemen of Verona- A.J. Cronin 4. To be a Somebody, Remain a Nobody by K S Ram 5. Brief answers to questions: AI	09
3. Comprehension of Passage	3a. Articulate single or multiple sentences. 3b. Comprehend main ideas and demonstrate them. 3c. Analyze and assess the information and ideas gathered from the given articles.	Articles for reading 3.1 Be Remarkable 3.2 Our Muddled Generation 3.3 Employers look for potential Employees	06
4. Speaking Skills	4a. Apply correct pronunciations. 4b. Compose sentences with correct intentions and sense. 4c. Associate correct accent/stress to the	Sample situations for conversational practice 4.1 Introducing yourself and others. 4.2 Meeting and parting. 4.3 Requesting information 4.4 Inquiries and information. 4.5 Asking, Giving and Refusing	06

	given words.	4.6 Permission. Apologizing to an individual/ office.	
5. Writing Skills	5a. Develop and expand ideas into paragraphs. 5b. Exercise speeches as per given situation.	5.1 Paragraph writing: Elaborate and expand ideas, Types of paragraphs 5.2 Speech writing: Introducing the guests and vote of thanks.	05
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Perform Tense Busters -All levels(To be performed in language lab)	Application of Grammar	06
2	Transform given sentences into active and passiveVoice	Application of Grammar	02
3	Practice narration(Direct & Indirect Speech)	Application of Grammar	02
4	outline an introduction- for self & others	Speaking Skills	02
5	Build Vocabulary for different situations	Text	04
6	Read and make notes on given topic	Text	02
7	Write a paragraph on given topic	Writing Skills	06
8	Conduct a Book Review	Writing Skills	02
9	Practice Dialogue Writing & presentation	Writing Skills	02
10	Conduct Comprehension of Passage	Comprehension passage	02
11	Prepare Speech and Present: 1) Introduction of guests 2) Vote of thanks	Speaking Skills	02
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Application of Grammar	02(00)	03(00)	00(02)	05(02)
2	Text	04(02)	06(03)	00(00)	10(05)
3	Comprehension of Passage.	02(00)	06(00)	00(00)	08(00)
4	Speaking Skills	00(00)	00(00)	03(04)	03(04)
5	Writing Skills	00(00)	00(00)	04(03)	04(03)
	Total	08(02)	15(03)	07(09)	30(14)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	2	R	2	3	R	2	1	A	2	2	R	2	4/6
2	2	U	3	3	U	3	1	U	3	2	U	3							3/4
3	4	A	3	2	U	3	3	U	3	5	A	3							3/4
4	5	A	4	4	A	4													1/2

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	15	--	Test Answer Scripts	1, 2, 3,4,5
		Class Room Assignments		Assignments	05	--	Assignment Book	1, 2, 3,4,5
	TEE (Term End Examination)	End Exam	Students	End of the Course	30	12	Theory Answer Scripts	1,2,3,4,5
				Total	50	20		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	25	10	Practical Answer Scripts	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5
	End of Course Survey			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Performance	05
2	Overall presentation of given assignment	05
3	Viva voce	10
4	Activity	05
	TOTAL	25

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	-	-	-	-	-	3			
2	3	-	-	-	3	-	3			
3	-	2	-	-	3	-	-			
4	-	-	-	-	3	-	3			
5	3	2	-	-	-	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	How to Win Friends and Influence people: Six ways to make people like you	Dale Carnegie, Rupa; First edition (20 May 2016)	978-8129140173
2	When life gave me lemons	https://storymirror.com/read/english/story/when-life-gave-me-lemons/krd7xe09 ,	
3	Two gentleman of Verona	A.J.Cronin, Oxford University Press 2013	
4.	To be a somebody remain a nobody	K.S.Ram[Author] Times of India [Publisher] 20edition December 2004	
5	Brief answers to questions: Artificial Intelligence	Stephen HawkingHodder&Stoughton, 16 October 2018	9781529345421
6	Our muddled generation.	Dinesh Kumar,Manish Sabharwal,Golden Harvest,	9788125059523

7	High School English Grammar and Composition	Wren and Martin Revised by Dr.N.D.V.PrasadaRao,	High School English Grammar and Composition
8	Contemporary English Grammar-structure and composition	David Green Revised Edition,2004 Himalaya Publication	033392183-6
9.	Interactive English	S.K.Gangal, Revised Edition 1997 Allied Publishers	81-7023-678-9
10	Applied English Grammar and composition.	Dr. P.C. Das, 2013, New Central Book Agency.	978-81-7381-542-3
11	English for Practical Purposes	Z. N. Patil, B.S. Valke	033935098

❖ **E-REFERENCES:**

- <https://storymirror.com/read/english/story/when-life-gave-me-lemons/krd7xe09>, Assessed on 25th July, 2021
- www.talkenglish.com-grammar , Assessed on 12th July, 2021
- www.perfect-english-grammar.com , Assessed on 18th March, 2021

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.RupaliLondhe	Lecturer in English & Coordinator	Government Polytechnic, Nagpur.
2	Prof NitinPote	Expert, Lecturer in English	Government Polytechnic, Bramhapuri
3	Prof Ravindra Suryawanshi	Expert, Lecturer in English	NIT Polytechnic, Nagpur
4	Prof NitinPathak	Expert, Lecturer in English	Kamptee Polytechnic, Nagpur
5	Dr.M.M.Machale	Lecturer in English	Government Polytechnic, Nagpur.
6	Mrs. Kamala Grace	Visiting Lecturer in English	Government Polytechnic, Nagpur.
7	Mrs.Swati Mahatme	Visiting Lecturer in English	Government Polytechnic, Nagpur.
8	Ms.Rasika Joshi	Visiting Lecturer in English	Government Polytechnic, Nagpur.
9	Mrs.Barnali Roy	Visiting Lecturer in English	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/AE/PK/MT/TX/MC
COURSE CATEGORY	: ENGINEERING SCIENCE COURSE
COURSE CODE	: WS151G
COURSE TITLE	: ENGINEERING WORKSHOP PRACTICE
TEACHING SCHEME	: TH:00; TU: 00;PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: 02 HRs
PT. EXAM	: --

❖ **RATIONALE:**

Workshop Practice is an engineering science course. The knowledge of this course is essential for technician industry to perform his/her duties. Working in workshop develops the attitude of groups working and safety awareness. This course provides industrial environment in the educational institute.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Adapt safety precautions in workshop and observe punctuality.
2. Read and interpret job drawing.
3. Use hand tools for various operations.
4. Apply basic techniques in manufacturing processes.
5. Operate different equipment/machineries used in basic shops.
6. Perform jobs according to drawing.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Observe the demonstration of hand tools, machine Tools and equipment used in Carpentry Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Carpentry	04
2	Prepare utility job involving related carpentry operations. (Job to be prepared by group of 2 to 4 students depending on volume of work)		08
3	Observe the demonstration of hand tools, machine Tools and equipments used in Welding Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Welding	02
4	Prepare utility job involving related Welding operations. (Job to be prepared by group of 2 to 4 students depending on volume of work)		08
5	Observe the demonstration of hand tools, machine Tools and equipments used in Fitting Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Fitting	02
6	Prepare One individual job involving related Fitting operations.		08
7	Observe the demonstration of hand tools, machine Tools and equipments used in Smithy Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Smithy	02
8	Prepare One individual job involving related Smithy operations.		08
9	Observe the demonstration of hand tools, machine Tools and equipments used in Plumbing Shop. Draw the sketches; write specifications, details, applications and safety rules of above tools.	Plumbing	02
10	Prepare One individual job involving related Plumbing operations.		08

11	Observe the demonstration of hand tools, machine Tools and equipments used in Sheet Metal Shop. Draw the sketches; writespecifications, details, applications and safety rules of above tools.	Sheet Metal	04
12	Prepare utility job involving related Sheet Metal Shop operations. (Job to be prepared by group of 2 to 4 students depending on volume of work)		08
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:** Nil

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:** Nil



❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Who m	Frequency	Max Mar ks	Min Mark s	Evidence Collected	Course Outcom es
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	-	-	-	-
		Class Room Assignmen ts		Assign- ments	-	-	-	-
	TEE (Term End Examination)	End Exam	Students	End of the Course	-	-	-	-
				Total	-	-		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessmen t of Practicals	Students	End of Every Practical	20	--	Jobs and Assessment sheet	1, 2, 3,4,5,6
		Journal Writing		Assignment	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Job and Assessment sheet	1,2,3,4,5, 6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Job Drawing	10
2	Handling Tools, machineries and its operations	10
3	Dimension Accuracy	20
4	Overall finishing of Job	10
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:****For Mechanical Engineering:**

Course Outcomes (COS)	Program Outcomes (POs)							PSO	PSO
	1	2	3	4	5	6	7	1	2
1	-	-	-	2	2	2	2	2	-
2	3	3	-	2	2	2	2	-	-
3	1	1	-	2	2	1	2	-	-
4	1	1	-	3	2	1	2	-	-
5	3	1	-	3	3	1	2	2	-
6	3	2	-	3	3	2	3	2	-

For Other Programs:

Course Outcomes	Program Outcomes (POs)							PSO	PSO
	1	2	3	4	5	6	7	1	2
1	-	-	-	2	2	2	2	2	-
2	3	3	-	2	2	2	2	-	-
3	1	1	-	2	2	1	2	-	-
4	1	1	-	3	2	1	2	-	-
5	3	1	-	3	3	1	2	2	-
6	3	2	-	3	3	2	3	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Course in Workshop Technology	B.S. Raghuwanshi; Dhanpat Rai sons, New Delhi ; 2006, 2011	10-0000017108
2	Elements of Workshop Technology	Hajra; Choudhary; Media Promoters & Publishers Mumbai, 2009	10-8185099146
3	A Textbook of Manufacturing	Gupta J.K., R.S. Khurmi S.Chand & Co. New Delhi	81-219-3092-8

	Process (Workshop Tech.)		
4	Workshop Practice Manual for Engineering Diploma & ITI Students	R K Hegde, Sapna Book House, 2012	13: 9798128005830

❖ **E-REFERENCES:**

- <http://books.google.co.in/books/isbn=9380026757> , accessed on 29 May 2021
- <http://www.asnu.com.au/profile./our-process.aspx> , accessed on 29 May 2021
- <https://www.youtube.com/watch?v=swnEQ17cQW>, accessed on 29 May 2021
- <https://www.youtube.com/watch?v=c-FN4M77qyA>, accessed on 29 May 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Welding Transformer (Air Cooled) Single Phase
2. Welding Transformer (Oil Cooled) Three Phase
3. Gas Welding Set
4. Bench Drilling Machine
5. Hydraulic Power Saw Machine
6. Bench Grinder
7. Bench Vise
8. Wood Turning Lathe Machine
9. Circular Saw Machine
10. Portable Wood Cutting Machine
11. Portable Drilling Machine
12. Carpentry Vice
13. Pipe Bending Machine
14. Pipe Vice
15. Pipe Cutter
16. Black smith Hearth
17. Anvil
18. Swage Block
19. Sheet Bending Machine
20. Sheet Cutting Machine
21. Brazing Equipment
22. All Hand Tools and Measuring Tools use in Carpentry Shop, Fitting Shop, Welding Shop, Plumbing Shop, Smithy Shop and Sheet Metal Shop,

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Shri A.W.Wankhade	Workshop Superintendent	Government Polytechnic, Nagpur.
2	Shri.K.S.Thekedar	Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
3	Er.A.M.Onkar	Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
4	Shri.G.F.Potbhare	Principal	NIT, Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN EE/CM/IT/EC/MT/TX/AI
COURSE CATEGORY	: ENGINEERING SCIENCE COURSE
COURSE CODE	: ME151G
COURSE TITLE	: ENGINEERING GRAPHICS
TEACHING SCHEME	: TH:00; TU: 00;PR: 04(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: 02 HR
PT. EXAM	: --

❖ **RATIONALE:**

Engineering graphics is a non-verbal and graphical language to communicate ideas, instructions and facts with each other clearly and without ambiguity while carrying out engineering jobs on the sites, shop floor etc. It describes the fundamentals, facts, concepts, principles and techniques of Engineering Graphics. The course illustrates techniques of drawing in an engineering field. It helps to develop the idea of visualizing the actual object or part on the basis of drawings and blueprints. This course is useful in developing drafting and sketching skills of the student. This preliminary course aims at building a foundation for the further course in drawing and other allied courses.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.
2. Redraw the given drawing by using appropriate geometrical construction.
3. Sketch different types of engineering curve by different methods.
4. Draw isometric projections into orthographic projections.
5. Visualize three dimensional objects and draw isometric projections.
6. Draw freehand sketches of a given engineering element.

❖ **COURSE DETAILS:****A. PRACTICALS :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	PR Hrs
1. Principles of Drawing	1a. Use of instruments for drawing, scales, lines and their applications. 1b. Use of IS:SP-46. 1c. Loci of points from given data.	1.1 Use of different drawing instruments and equipment 1.2 Types of letters and numbers (single stroke vertical and numbers only) 1.3 Conventions of lines, 1.4 Dimensioning technique as per IS:SP-46 1.5 Scales :(reduced, enlarged and full size)-Plain scale, diagonal scale.	06
2. Redraw and Loci of Points	2a. Learn different geometrical construction methods. 2b. Drawing locus of point from given data.	2.1 Different geometrical construction Methods and Redrawing. 2.2 Loci of points	06
3. Engineering Curves.	3a Draw an ellipse by given method. 3b Draw parabola by given method. 3c Draw hyperbola by given method. 3d Draw involute, and state their applications. 3e Draw a given cycloid and state its applications .	3.1 To draw an ellipse by- i) Arcs of circles method ii) Concentric circles method 3.2 To draw parabola- i) Rectangle method ii) Directrix- focus method 3.3 To draw hyperbola by- i) Passing through a given point With reference to given asymptotes ii) Directrix- focus method 3.4 To draw involutes of circle and Polygon of maximum six sides 3.5 To draw cycloid, epi-cycloid and hypo-cycloid	12
4. Orthographic Projections.	4a. Visualize, interpret and draw orthographic views from given pictorial views. 4b. Difference between first angle and third angle method of projection. 4c. Use of IS:SP-46 for dimensioning technique.	4.1 Introduction to orthographic Projection. 4.2 First angle and Third angle method of projections. 4.3 Conversion of simple pictorial views into orthographic views and dimensioning techniques as per IS. SP-46	14

5. Isometric Projections	5a. Visualize, interpret and draw Isometric views from given orthographic views.	5.1 Isometric scales 5.2 Isometric views of simple object (plane surfaces, slanting surfaces, and Rectangular, V, Trapezoidal slots)	14
6. Freehand Sketches	6a. Prepare proportionate freehand sketches of given machine elements. 6b. Describe functions and use of machine element.	6.1 Types of screws and threads profile– Vee and square, acme, buttress, seller, BA threads, knuckle threads. 6.2 Bolts–square and hexagonal bolts, eyebolt 6.3 Types of nuts: square, hexagonal, wing 6.4 Foundation bolts: Eye foundation bolt, Rag foundation bolt, Lewis foundation bolt 6.5 Single and double Riveted Lap and Butt joints	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Draw types of lines, lettering, numbers and two problem from sub topics 1.5 of Unit 1 (01 Sheet)	1 Principles of drawing	06
2	Draw two problems each from subtopic 2.2 and 2.3 from Unit 2 (01 Sheet)	2 Redraw and Loci of Points	06
3	Draw Engineering Curves, one problem from each sub topic of Unit 2. (01 Sheet)	3 Engineering Curves	12
4	Draw two problem using first angle method of projection (01 Sheet)	4 Orthographic Projections	14
5	Draw one problem with plane surfaces & other with slot, slanting surfaces (using natural scale and isometric scale) (01 Sheet)	5 Isometric Projections	14
6	Draw Free Hand Sketches–any ten sketches covering all the topics under Unit 6 (01 Sheet)	6 Free Hand Sketches	12
Total Hrs.			64

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Nil

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER**

Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	-	--	-	-
		Class Room Assignments		Continuous	-	--	-	-
	TEE (Term End Examination)	End Exam	Students	End of the Course	-	-	-	-
				Total	-	-		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Drawing Sheets	1, 2, 3,4,5,6
		Drawing Portfolio		Assignments	05	--	Drawing Portfolio	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Drawing Answer sheets	1, 2, 3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max.Marks
1	Neatness , cleanliness and line work on drawing sheet	10
2	Creation of given drawing with proper dimensioning	20
3	In time submission	10
4	Viva Voice	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcome s (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	3	2	-	—	—	2	—	—
2	3	3	3	-	—	—	2	—	—
3	3	3	3	-	—	—	3	—	—
4	3	3	3	-	—	—	3	-	—
5	3	3	3	-	—	—	2	-	—
6	3	3	3	-	—	—	2	-	—

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Engineering Drawing Practice for Schools And Colleges IS:SP-46	Bureau of Indian Standards, Reprint in , 2003	8170610192
2	Engineering Drawing	N.D.Bhatt, Charotar Publishing house 53 rd Edition 2019	9789380358963
3	Geometrical and Machine Drawing	N.D.Bhatt & V.M Panchal, Charotar Publishing house, 20 th Edition 2014	9789380358895
4	Engineering Drawing	D.A.Jolhe, Tata McGraw Hill Edu.2010	978-0-07-064837-1
5	Engineering Drawing	R.K.Dhawan , Published by S.Chand & co. 2012	9788121914314
6	Engineering Drawing	P.J Shaha, S.Chand & co. 2013	8121941822

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=ANEvQyt3PnU> accessed on 30 June 2021
- <https://www.youtube.com/watch?v=-W7tH49dBLw> accessed on 30 June 2021.
- <https://www.youtube.com/watch?v=FXP3tKedM5g> accessed on 30 June 2021.

- <https://www.youtube.com/watch?v=j5nwO-JwVv4&list=PLDN15nk5uLiBpnIOK5r3KXdfFOVzGHJSt> accessed on 30 June 2021.
- [https://www.youtube.com/watch?v=77ufJXvXUk4&list=PLIhUrsYr8yHxVky7bfrnbRcdXcHjT_K83&index=2\(Iso\)](https://www.youtube.com/watch?v=77ufJXvXUk4&list=PLIhUrsYr8yHxVky7bfrnbRcdXcHjT_K83&index=2(Iso)) accessed on 30 June 2021.
- <https://www.youtube.com/watch?v=Jzr5PTbvkVI&list=PL1xA-ZWMKpOMt3ew5vcn3keBxlqHKtlg> accessed on 30 June 2021.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

- 1 Drawing Board with drawing instruments
- 2 Mini-drafter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Shri. P.V. Rekhade	HOD, Mechanical Engineering	Government Polytechnic, Nagpur
2	Dr. R. G. Choudhari	HOD, Mechanical Engineering	Government Polytechnic, Nagpur
3	K. S. Thekedar	Course Expert & Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
4	Y. K. Gaiki	Course Expert & Lecturer in Mechanical Engineering	Government Polytechnic, Nagpur.
5	Er. A.M.Onkar	PBOS Member & Chief Executive Officer	Onkar Furnitures, MIDC, Nagpur
6	Shri. G.F. Potbhare	PBOS Member & Principal	NIT, Polytechnic, Nagpur
7	Shri. G.H. Dahole	MSBTE Representative & Lecturer in Mechanical	Govt. Polytechnic, Gondia

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/CM/IT/PK/MT/TX/ TR/MC/AI
COURSE CATEGORY	: ENGINEERING SCIENCE COURSE
COURSE CODE	: IT151G
COURSE TITLE	: INTRODUCTION TO IT SYSTEMS
TEACHING SCHEME	: ONLINE COURSE FOR CREDIT TRANSFER
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: --
PT. EXAM	: --

❖ **RATIONALE:**

Information Technology (IT) is an essential tool that we cannot avoid as it plays an important role in our day to day life, especially in the present scenario. Introduction to IT Systems course starts with the basic computer skills, learning basic application software tools, Understanding Computer Hardware, Basic Internet awareness.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply the basics of computer fundamentals.
2. Identify Basic Internet skills.
3. Demonstrate the use of different Office Tools.
4. Recognize various computer hardware components.
5. Install, configure and maintain the operating system.
6. Identify and illustrate the use of Digital India portals (state and national portals).

❖ **COURSE DETAILS:**

Students Can select any ONE from Online Course from A), B) , C) given below. A student must obtain a certificate for passing the examination of selected course.

A) **Spoken Tutorial (IIT Mumbai) :-**

Module I –Introduction to Computer -- Duration 5 Hrs

Module II - Any two course modules from following

- a) LibreOffice –Writer--10 hours
- b) LibreOffice –Calc -- 12 hours
- c) LibreOffice-Impress --08 hours

Students can register for the above online course modules on Spoken Tutorial Portal in first semester. However institute registration shall be done as per program structure. Program department shall appoint one faculty as mentor to this on line activity.

B) **Swayam** :-Course Module:- Course in Information Technology—08 Weeks duration

C) Any equivalent course as compared to above from MOOCs available .

❖ **SPECIFICATION TABLE FOR THEORY PAPER:Nil**❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:Nil**

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Class Room Assignments		Assignments	--	--	--	--
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:** Online Examination❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:IT Dept.**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	3	--	--	--	--	3	3	--
2	3	3		--	--	--	3	3	--
3	3	3	3	3	--	--	3	3	--
4	3	3	--	3	--	--	3	3	--
5	3	3	--	3	--	--	3	3	--
6	3	3	--	--	--	--	3	3	--

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Computer Fundamentals	R.S. Salaria Khanna Publishing House	ISBN: 9789381068533
2	Computer Course Made Easy	Ramesh Bangia Edition: 1	ISBN 13: 9789382609377
3	Internet Applications	Ikvinderpal Singh	ISBN 10: 9381068399

❖ **E-REFERENCES:**

- <https://www.latex-tutorial.com/tutorials/> accessed on 22/6/2021
- <http://www1.maths.leeds.ac.uk/LaTeX/TableHelp1.pdf> accessed on 22/6/2021
- <https://www.wikihow.com/Create-a-Website-Using-Google-Sites> accessed on 22/6/2021
- <http://www.tutorialsforopenoffice.org/> accessed on 22/6/2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Computer System (with latest specifications)
2. MS Office 2007 Professional or latest version
3. PC tools
4. Windows 7

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.A.R.Mahajan	HoD, Information Technology	Government Polytechnic, Nagpur.
2	Mr. Dipak Dhote	Operations Manager, IT- Network Infosystems Pvt LTD	Industry Expert
3	Dr. Rakesh Kadu	Assistant Professor, I.T., Ramdeobaba College of Engg, and Management, Nagpur.	Member from Academics(External)
4	Mrs.V.A.Raje	Lecturer in C.O., G.P.Arvi	MSBTE Nominee
5	Mr. M.N.Gawande	Lecturer in Electrical Engg.	CDC In Charge
6	Mrs.D.P.Chanmanwar	Lecturer in IT	Member (Internal)
7	Mr.L.D.Vilhekar	Lecturer in IT	Member (Internal), Course Expert
8	Mr. S.J.Pukale	Lecturer in IT	Course Expert

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/CM/IT/MT/PK/AE/TR/
TX/MK

COURSE CATEGORY : HUMANITIES & SCIENCE COURSE

COURSE CODE : LS151G

COURSE TITLE : LIFE SKILLS

TEACHING SCHEME : TH:00; TU:00;PR: 02 (CLOCK Hrs.)

TOTAL CREDITS : 01(TH/TU CREDIT = 0 , 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE EXAM : --

PR. TEE EXAM : --

PT. EXAM : --

❖ RATIONALE:

According to NASSCOM and other agency surveys conducted, suggests that today's Diploma engineers are technically solid, can do linear programming problems, solve issues quickly but lack in Interpersonal and Communication skills. The list of required life skills include communication, leadership, team work, public speaking, attitude, ethics, professional etiquettes etc. This 'disconnect' between the desired skills and the qualifications and skills obtained needs to be addressed. Bridging the gap between Formal technical education and Industry's requirements, an interface between Industry and Institute is very essential. A pre-employment training in these life skills therefore becomes the essential part of the curriculum of Diploma programmes. to prepare job ready students for industries. This will enhance the employability and the industry connect for the students and will reduce the gestation period of students in Corporate world.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Acquire knowledge of Self discovery.
2. Build essential soft skills.
3. Enhance professional competencies

4. Adapt ethics and values.
5. Develop interpersonal skills.
6. Maintain physical and mental fitness.

❖ **COURSE DETAILS:**

A. THEORY :

Units	Specific Learning Outcomes(Cognitive Domain)	Topics and subtopics	Hrs
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

S.No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	1. Prepare a draft of personal information. 2. Practice and perform self introduction. 3. Demonstrate appropriate body language during self intro and introducing others.	A. Soft Skills Understanding self & Others a. Self Introduction b. Introducing others	2 hrs
2	1. Practice Yoga Asanas recommended in AYUSH Common Yoga Protocol (Tadasana, Vrikshasana, Pada-hastasana, Trikonasana, Ardha-Chakrasana etc) for good health and fitness. 2. Prepare a diet chart for - Teenagers/Old age people/Diseased person etc. 3. Prepare a table of Do's and Don'ts of Habit formation.	B. Life Skills Mental & Physical Health a. Warm up b. Yoga c. Habit formation- Do's & Don'ts d. Diet Pyramid	4 hrs
3	1. Practice Pranayamas recommended in AYUSH Protocol (Anulom vilom, Kapalbhathi, Bhramari Pranayama, Bhastrika, Surya Bhedan etc) for good health and fitness. 2. Practice different types of meditation -Mindfulness meditation, Loving Kindness Meditation, Yoga Meditation.	B. Life Skills Mental & Physical Health a. Pranayam b. Meditation	4 hrs
4	1. Practice and perform Group Discussions on topics/ issues of	A. Soft Skills Personality	2 hrs

	relevance. 2. Demonstrate appropriate dress and appearance for formal conversation. 3. Exhibit suitable non verbal codes of communication.	Development a. Group Discussion b. Personal grooming c. Verbal-Non Verbal communication	
5	1. Draft pros and cons on given topic of Debate. 2. Practice sessions on Debate on current affairs.	C. Employability Skills Interpersonal Skills a. Public Speaking b. Analytical thinking	2 hrs
6	1. Prepare draft for seeking permission to organize academic activity/event/visit etc. 2. Prepare checklist of things to do and schedule for organizing academic activity/event/visit etc. 3. Exercise activities (2 to 3) based on confidence building- such as Interviewing of field experts, organizing industrial visits and submitting reports etc.	C. Employability Skills Effective Management a. Planning b. Motivating self & others	4hrs
7	1. Jot down the qualities and skills of successful entrepreneur to prepare presentation on his/her achievements and contribution. 2. Prepare and present presentation on Learning lessons from Biographies of industrialists (like Rusy Modi, Dhirubhai Ambani, Ratan Tata, Narayana Murthy etc.	D. Presentation Skills - Corporate Culture a. Attitude b. Creativity & Innovation	4hrs
8	1. Investigate and examine industry related issues and prepare a case study on it. 2. Present case studies based on industry related issues like-indefinite labour strike, accidents , customer complaints, employees' career requirements.	D. Presentation Skills - Problem Solving a. Critical Thinking b. Problem Analysis	2 hrs
9	1. Jot down the lacunas of the entrepreneur which caused fall in business. 2. Prepare and present presentations on Learning lessons from failure business stories.	D. Presentation Skills - Learning Attitude a. Adaptability b. Persistence	2 hrs

10	1. Participate and practice in basket exercises / Games related to Team Working & Leadership. 2. Exhibit leadership qualities in group task.	A. Soft Skills Interpersonal Skills a. Working in a team b. Leadership	2hrs
11	1. Demonstrate exercises on Problem solving in Assertive communication (Role Play). 2. Incorporate assertive communication in given situation.	A. Soft Skills Interpersonal Skills a. Positive Thinking b. Assertiveness	2 hrs
12	1. Set short term and long term career goals. 2. Practice sessions on Time management (Prepare schedule to achieve short term and long term goals).	A. Soft Skills Effective Time Management a. Goal Setting b. Time Management	2 hrs
Total Hrs.			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:** Nil

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:** Nil



❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Who m	Frequency	Max Mark s	Min Mark s	Evidence Collected	Course Outcome s
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)		--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments		--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course			Theory Answer Scripts	1,2,3,4,5, 6
				Total				
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course			Practical Answer Scripts	1,2,3,4,5, 6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Presentation Skills	10
2	Communication	10
3	Motivation	10
4	Confidence/Enthusiasm	05
5	Interpersonal Skills	10
6	Viva voce	05
Total		50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	-	-	-	-	-	2	3	-	-	-
2	-	-	-	-	-	2	3	-	-	-
3	-	-	-	-	-	3	3	-	-	-
4	-	-	-	1	1	3	3	-	-	-
5	-	-	-	-	-	3	3	-	-	-
6	-	-	-	-	-	2	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Yoga Therapy	Angarai, G. M. and Indra Mohan, Shambhala Publications, 2 nd Edition, January 1, 2014.	ISBN-13 9781590301319
2	The ACE of Soft Skills: Attitude, Communication and Etiquette for Success	Gopalaswamy R. and Mahadevan Pearson Publication, 1 st Edition, 13 May 2010.	ISBN-13 978-8131732854
3	Simple Art of Business Etiquette: How to Rise to the Top by Playing Nice	Jeffrey L Seglin, Tycho Pr Publication, 12 January 2016	ISBN-13 978-1623156886
4	The Big Book of Team-Motivating Games	Edward Scannell and Mary Scannell, McGraw-Hill Education, 7 October 2009	-----

5	Team Building: Proven Strategies for Improving Team Performance	W. Gibb Dyer , Jeffrey H. Dyer , and William G. Dyer, 5th Edition, Jossey-Bass, 3 January 2013	ISBN-13 978-1118105139
6	How to Win Friends & Influence People	Dale Carnegie, Pocket Books October 1, 1998	ISBN-10 0671027034
7	Famous Industrialists: Famous Biographies for Young People	Sigmund A. Lavine, Literary Licensing, LLC, 13 October 2012	ISBN-13 978-1258497026
8	Why Entrepreneurs Really Fail	Buchia Nozer, Bloomsbury, October 1, 1998	ISBN-13 9789382951605

❖ **E-REFERENCES:**

- <http://ihmshimla.org/wp-content/uploads/2013/05/Industrial-Training-Rule-Book.pdf>, accessed on 25th July, 2021
- <https://www.oliveboard.in/blog/from-rags-to-riches-indias-most-inspiring-success-stories>, accessed on 23rd May, 2021
- <https://coach.basketball.net.au/10-simple-team-building-activities-for-your-under-14s>, accessed on 14th June, 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Prof. Deepak Kulkarni	Soft Skills Trainer & Councilor	Consultant, Nagpur
2	Dr. Shabbir Zukerya	Director	Learner's Academy for Skill Development, Nagpur
3	Mr. Anand Toal	Director	International Placements, Nagpur
4	Dr. Megha Machale (Bhelande)	Lecturer in English	Government Polytechnic, Nagpur.
5	Prof. Yogesh Chandarana	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.
6	Mr. Manish Gawande	In-Charge, Curriculum Development Cell	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

**PROGRAMME : DIPLOMA IN EC/IT/MC/EE/CM/CE/ME/AE/PK/
TR/TX/MT/AI**

COURSE CATEGORY: AUDIT COURSE

COURSE CODE : IC151G

COURSE TITLE : INDIAN CONSTITUTION

TEACHING SCHEME: TH:01; TU: 00; PR: 00 (CLOCK HRs.)

TOTAL CREDITS : -

TH. TEE EXAM : -

PR. TEE EXAM :-

PT. EXAM : -

❖ **RATIONALE:**

The Constitution of India is the supreme law of India. The document lays down the framework that demarcates fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens. Engineer has to perform different works related to project planning, constructing project work, lead a group of workers etc. Engineer must also know about different bodies of administration, fundamental rights of citizen, different levels of Indian Union. Hence every Diploma Holder should have knowledge about Indian Constitution.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Interpret policies of government.
2. Outline structure of Indian Union.
3. Describe functions of State Secretariat and different Ministries .
4. Describe structure of District Administration.
5. Describe role and functions of Chief Election Commissioner.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Topics and Subtopics	Hrs.
1. The Constitution - Introduction	1.1 The History of the Making of the Indian Constitution 1.2 Preamble and the Basic Structure, and its interpretation 1.3 Fundamental Rights and Duties and their interpretation 1.4 State Policy Principles	04
2. Union Government	2.1 Structure of the Indian Union 2.2 President – Role and Power 2.3 Prime Minister and Council of Ministers 2.4 Formation of Lok Sabha and Rajya Sabha and its functions	04
3. State Government	3.1 Role and Power of Governor 3.2 Role and Functions of Chief Minister and Council of Ministers 3.3 Functions and Powers of State Secretariat	03
4. Local Administration	4.1 Structure of District Administration 4.2 Functions of Municipal Corporation 4.3 Functions of Zila Parishad	03
5. Election Commission	5.1 Role and Functions of Chief Election Commissioner 5.2 Role and Functions of State Election Commission	02
	Total	16

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assignment on each topic (Total 5 Assignments)

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Class Room Assignments		Assignments	--	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	Theory Answer Scripts	1,2,3,4,5,6
				Total	--	--		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	--	--	--	--
		Journal Writing		Assignments	--	--	--	--
				Total	--	--		
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	-	-	-	-	3	-	3	-	-	-
2	-	-	-	-	3	-	3	-	-	-
3	-	-	-	-	3	-	3	-	-	-
4	-	-	-	-	3	-	3	-	-	-
5	-	-	-	-	3	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Ethics and Politics of the Indian Constitution	Rajeev Bhargava, Oxford University Press, New Delhi, 2008	
2	The Constitution of India	B.L. Fadia, Sahitya Bhawan; New edition (2017)	
3	Introduction to the Constitution of India	DD Basu, Lexis Nexis; Twenty-Third 2018 edition	

❖ **E-REFERENCES:**

- <https://www.constitution.org/cons/india/const.html>
- <http://www.legislative.gov.in/constitution-of-india>
- <https://www.sci.gov.in/constitution>
- <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.D.D.Lulekar	HoD, Electrical Engg. Deptt.	Government Polytechnic, Nashik.
2	Prof.A.M.Arekar	Lecturer In Electrical Engg.	Government Polytechnic, Nagpur
3	Mr.M.N.Gawande	Lecturer In Electrical Engg.	Government Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ME/AE/CE/EE / ET/PK/ MT/TX/IT/CM / MC / AI
COURSE CATEGORY	: BASIC SCIENCE COURSE
COURSE CODE	: CH101G
COURSE TITLE	: CHEMISTRY
TEACHING SCHEME	: TH: 03; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ **RATIONALE:**

Chemistry is the basic science which is essential to all engineering courses. For an engineer, the usage of equipment's and instruments would require knowledge of chemical substances, their composition and properties. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to all engineering fields. Chemistry subject knowledge also aims to bridge the theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in the field of engineering. This will be gateway for development of reasoning capacity of students and understanding new technology as well.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Predict the valency and application of catalyst in industry.
2. Select metal and nonmetallic materials for industrial application.
3. Select Engineering materials on the basis of properties and application.
4. Apply knowledge related with Electrochemistry, and fuel Cells.
5. Apply the knowledge of preventive measures in Industry.
6. Analyze different type of energy sources for sustainable development.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Chemical Bonding & Catalysis	1a. Predict valence electrons and type valence of elements. 1b. Formulate given molecule on the basis of given type. 1c. Differentiate between electrovalent and covalent compound on basis of given properties. 1d. Describe given type of catalysts, catalysis. 1e. Select the relevant catalyst for given application.	1.1 Valency: Definition & types of valence (Electrovalence & Covalence). Octet Rule, Duplet Rule. 1.2 Formation of Electrovalent e.g., NaCl, CaCl ₂ , MgO. and Formation of Covalent Compounds CO ₂ , NH ₃ , N ₂ . 1.3 Distinction between electrovalent & covalent compounds (formation, M.P. B.P., Type of bond, Solubility, strength of bond) Catalysis: 1.4 Definitions of catalyst Types of Catalyst, Positive Catalyst, Negative Catalyst, Auto - catalyst.: Definitions of catalysis, Types of catalysis. 1.5 Industrial Application of Catalyst.	06
2. Metallurgy, Alloy & Polymer	2a. Describe given terms in metallurgy. 2b. Describe given process of metal extraction. 2c. Select proper alloy for given application or vice versa. 2d. Distinguish between thermo softening and thermosetting plastics on given points. 2e. Select the given Plastic Polymer for Industry application. 2f. Apply given Thermal insulators in industry on their Characteristics.	2.1 Metallurgy: Definitions of terms used in metallurgy like Minerals, Ore, gangue, Flux, slag. Definition of metallurgy. 2.2 Flow chart of extraction process (Crushing, Concentration (physical and chemical), reduction, refining. 2.3 Definition of alloy, purposes of alloy formation, Types of alloys (ferrous alloy and nonferrous alloy) Composition properties and application of High-speed steel, Magnetic steel, Duralumin, Woods metal. 2.4 Polymer (plastic): Definition of polymer, types of polymers and difference of thermo softening and thermosetting plastics. 2.5 Formation of Plastic by Addition polymerization of Polyethylene, polystyrene. Formation of Plastic by Condensation process Bakelite plastic, nylon 6, 6. 2.6 Insulating material: Characteristics	08

		of Thermal insulators. Preparation, Properties & Applications of Thermocol & glass wool.	
3. Engineering Materials	3a. Describe functions & characteristics of given Lubricants. 3b. Select given lubricant on the basis of different types of machines. 3c. Detect the adverse effects of hard water as per given industry. 3d. Describe given type of water treatment process. 3e. Describe the given properties and applications of given construction material.	Lubricant: 3.1 Definition, Types of Lubricants, Functions of Lubricants. Characteristics of Lubricants- Viscosity, Volatility, viscosity Index, oiliness, cloud and pour point, Flash and fire point, Neutralization number. 3.2 Selection of Lubricant for various types of machines such as I.C engine, Gear system, cutting tools delicate and simple machines, tractors and rollers. Water: 3.3 Types of impurities in natural water. Definitions of hard and soft water, types of hardness. Adverse effects of hard water in: Industries- paper industry, textile industry, dyeing industry, sugar industry. 3.4 Potable water treatment: Sedimentation, Coagulation, filtration, sterilization (Chlorination method). Cement & Lime 3.4 Portland cement: Definition, chemical composition. Special Cements: Properties and application of water proofing cement, super sulphate cement. lime: Composition, properties and uses of fat lime, lean lime.	10
4. Electrochemistry	4a. Describe given terms involved in electrochemistry. 4b. Interpret degree of ionization on the basis of given factors. 4c. Describe the electroplating of given metal. 4d. Calculate the pH/POH of solutions with given concentration. 4e. Differentiate Primary and Secondary cells on given points. 4f. Use of Hydrogen-	Basic concepts of electrolysis: 4.1 Atoms, Ions, Electrolyte, conductivity of electrolytes, type of electrolyte- strong and weak electrolyte. 4.2 Ionization and electrolytic dissociation, Arrhenius theory of electrolytic dissociation, degree of ionization, factors affecting degree of ionization. Electrolysis 4.3 Faraday's laws of electrolysis: Faraday's First and Second law (Statement and mathematical expression) Application of electrolysis: Electro Plating of	09

	oxygen fuel cell in Engineering field.	copper and silver. pH and pOH: 4.4 Definition of pH, pOH, pH scale, numerical. Electrochemical cells/ batteries: 4.5 Basic concepts: cell, battery, distinction between Primary and secondary cells. 4.6 Fuel cell: Definition, construction, working, advantages, limitations and applications of Hydrogen-oxygen fuel cell.	
5. Corrosion	5a. Identify the given types of oxide film & its effect on corrosion. 5b. Describe mechanism of given type of corrosion. 5c. Choose different corrosion protection methods of metal and its use in given situation.	5.1 Definition of corrosion, Types of corrosion, mechanism of Atmospheric or chemical corrosion. Effect of oxide film on atmospheric corrosion. Factor effecting atmospheric corrosion. 5.2 Immersed Corrosion or Electrochemical Corrosion, definition, types and mechanism (Hydrogen evolution and oxygen absorption) 5.3 Application of Protective Coatings like metal coating by - Galvanizing, Tinning, Sherardizing, Metal Spraying, Metal Cladding	07
6. Energy & Pollution Control	6a. Compare given types of Fuel on given points. 6b. Analyse components of fuel by proximate analysis. 6c. Describe the properties and uses of given solid, liquid and gaseous fuel. 6d. Select proper pollution control methods for given type of pollution. 6e. Describe the significance of given E- waste Management methods for implementation of sustainable development.	Energy 6.1 Definitions of a fuel, Classification of fuels with suitable examples Characteristics of a good fuel, calorific value and ignition temperature, comparison between solid, liquid, gaseous fuels based on their properties. Classifications of fuel: 6.2 Solid fuels: analysis of solid fuels- Proximate analysis for determination of moisture, volatile matter, ash and fixed carbon, significance of Proximate analysis. 6.3 Liquid fuels: Bio diesel - properties, applications. Gaseous fuels: Composition, properties, applications of LPG, CNG Pollution control 6.4 Definition of pollution – Types of pollution (Air, water pollution) 6.5 3R Concept, recycling of plastic. E -waste management, sustainable development – significance of Wind	08

		Energy, Solar Energy.	
		Total Hrs.	48

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Pra cti- cals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Explore the chemistry laboratory.	Chemical Bonding & Catalysis	02
2	Analyse basic and Acidic Radicals of known salt solution-1 (Confirmatory Test) using qualitative analysis method.	Chemical Bonding & Catalysis	02
3	Analyse basic and Acidic Radicals of known salt solution-2 (Confirmatory Test) using qualitative analysis method.		02
4	Analyse basic and Acidic Radicals of known salt solution-3 (Confirmatory Test) using qualitative analysis method.		02
5	Determine the percentage of Iron in given steel sample by redox titration. (OR) Determine the percentage of copper in given alloy sample.	Metallurgy Alloys & Polymer	02
6	Prepare Phenol formaldehyde resin used in manufacturing of Bakelite Plastic.	Metallurgy Alloys & Polymer	02
7	Determine total hardness (permanent and temporary) of given sample of water by EDTA method.	Engineering Materials	04
8	Determine the percentage of calcium content in cement	Engineering Materials	02
9	Determine acid value of lubricant by KOH OR Determine coefficient of viscosity using Ostwald's Viscometer.	Engineering Materials	02
10	Determination of PH value of given solution by using PH meter.	Electrochemistry	02
11	Find the Electrochemical equivalent (ECE) of copper.	Electrochemistry	02
12	Find the relation between loss in weight of aluminium strip in acidic and alkaline medium and rate of corrosion	Corrosion	02
13	Determine the strength of given hydrochloric acid solution by titrating it against sodium hydroxide solution.		02

14	Determine the percentage of moisture and ash content in the given coal sample. by proximate analysis.	Energy & pollution control	04
		Total	32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Chemical Bonding & Catalysis	02(02)	03(03)	03(00)	08(05)
2	Metallurgy, Alloy & Polymer	04(00)	06(00)	00(06)	10(06)
3	Engineering Materials	00(02)	06(06)	06(00)	12(08)
4	Electrochemistry	02(00)	03(06)	06(00)	11(06)
5	Corrosion	02(02)	03(00)	03(03)	08(05)
6	Energy and Pollution control	02(00)	03(06)	06(00)	11(06)
	Total	12(06)	24(21)	24(09)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T-Unit/Topic Number

L- Level of Question

M-Marks

R-Remember

U-Understand

A-Analyze/ Apply

1R2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	2	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	3	R	2	5	R	2										
2	1	U	3	1	A	3	2	U	3	1	U	3	5	A	3				3/5
3	2	U	3	3	U	3	3	U	3	3	U	3	3	U	3				3/5
4	4	U	3	5	U	3	5	A	3	4	U	3	4	U	3				3/5
5	6	U	3	6	A	3	6	A	3	6	U	3	6	U	3				3/5
6	3	A	6	4	A	6	2	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Cours e Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3, 4, 5, 6
		Class Room Assignments		Assignments	15	--	Assignment book	1, 2, 3, 4, 5, 6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1, 2, 3, 4, 5, 6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous assessment of practical	Students	End of every practical	20	--	Journal	1, 2, 3, 4, 5, 6
		Journal Writing		Assignment	05	--	Journal	1, 2, 3, 4, 5, 6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1, 2, 3, 4, 5, 6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4, 5, 6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Writing chemical reactions, handling the equipment, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3									
2	3			3						
3	3			3	3		3			
4	3			3			3			
5	3				3		3			
6	3			3	3		3			

- 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Engineering Chemistry Jain and Jain	Engineering Chemistry Jain and Jain, Dhanpat Rai publishing company(P) ltd.15 edition	10092
2	Engineering Chemistry	Engineering Chemistry S. S. Dara, S. Chand Publication	15 th Edition
3	Engineering Chemistry	R. Sivakumar N. Sivakumar and Tata McGrawHill, edition10.	9780745-328896
4	Polytechnic Chemistry	Vedprakash Mehta, Jain brothers, 6 th Edition	13-9788183600134
5	Industrial Chemistry	Goel Publication, 8 th Edition	81877224002

❖ **E-REFERENCES:**

- http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_polymer_s- , accessed on 10 June 2021
- http://www.substech.com/dokuwiki/doku.php?id=full_index_of_articles_on_fluids-, accessed on 10 June 2021
- <http://www.asetute.com.au/corrosion.html>, accessed on 10 June 2021
- http://www.sherardizing.com/resources/files/9_Sherardizing_Corrosion.pdf , accessed on 10 June 2021
- <http://www.galvanizeit.org/aga/animation> , accessed on 10 June 2021
- http://www.ehow.com/list_6725219_different-types-metal-cladding.html , accessed on 10 June 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Electronic balance (measure up to 0.001 mg)
2. Battery 12 volt
3. Digital multi-meter
4. Rheostat assorted sizes
5. Voltmeter MI 0-150-300 V
6. Ammeter MI 0-5-10 A
7. Electrolytic cell set up
8. Digital PH meter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM : (786)**

Sr.No.	Name	Designation	Institute / Industry
1	Dr.M.I.Ahmed	Coordinator Sr. Lecturer in Chemistry	Government Polytechnic, Nagpur
2	Dr.S.A.Petkar	Lecturer Chemistry.	Government Polytechnic, Nagpur.
3	Dr.K.A.Nandekar	Lecturer Chemistry	G.H.Raisoni college of Engineering Nagpur
4	Dr.Prashant Zade	Lecturer Chemistry	Dharampeth Polytechnic, Nagpur
5	Prashant B.Chouke	Lecturer Chemistry	Government Polytechnic, Brahmpuri
6	Dr.D.K.Borikar	Lecturer Chemistry	Government Polytechnic, Nagpur
7	Dr.S.L.Sayre	Lecturer Chemistry	Government Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN EE/EC/MC
COURSE CATEGORY:	BASIC SCIENCE COURSE
COURSE CODE	: MH 103G
COURSE TITLE	: APPLIED MATHEMATICS
TEACHING SCHEME:	TH: 03 ;TU:01 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT=1 CLOCK HR.)
TH. TEE EXAM.	: 03 HRs
PR. TEE EXAM	: --
PT. EXAM	: 01 HR

❖ RATIONALE:

Mathematics is the backbone of Technical courses, Understanding of engineering concepts require logical approach and thinking. The course is extension of Basic Mathematics of first semester and stepping into the prerequisites to learn Calculus, Complex Number and Laplace Transform. Applied Mathematics lay down the foundation to understand and express principles and laws involved in other Technological courses.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply the concept of function to Identify and find the value Range, Domain, Co-Domain of the given function.
2. Apply methods of evaluation of limit to solve the given examples of limits .
3. Apply concept of limit define the first principal of derivatives, notation, understood the rules to solve the examples of derivatives.
4. Using integral of standard function, rules ,properties and methods to solve indefinite and definite integral problems
5. Apply the concept of differential equation which helps to solve engineering problems.
6. Express the complex number in Polar and Exponential form, Apply Laplace Transform to solve the engineering problems.

❖ COURSE DETAILS:

A.THEORY:

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs .
1. Functions	1a. Find the Range, Domain and Co-Domain of the given function. 1b. Find the value of given function. 1c. Identify the type of given functions. 1d. Check whether the given function is Odd or Even function	1.1 Concept of function, Domain, Co-Domain, And Range of the Functions. 1.2 Value of the function. 1.3 Types of functions:- Logarithmic, Inverse, Algebraic, Trigonometric,& Inverse(LIATE) 1.4 Even and odd function, Parametric, Composite , Implicit, Explicit Functions.	04
2. Limits	2a. Evaluate given limits by using Algebra of limits . 2b. Solve the limit of given trigonometric function. 2c. Evaluate limits of the given exponential functions. 2d. Evaluate limits of the given logarithmic functions.	2.1 Concept of limit. 2.2 Algebra of limits.(Addition Subtraction, Multiplication, Division) 2.3 Limits of algebraic functions (By Direct Method, Factorisation, & Rationalisation Method).Limits of Trigonometric function. Limit based on x tends to infinity, 2.4 Exponential Limits & Logarithmic Limits, Use of Logarithmic Limits for Exponential Limits.	
3. Derivatives and Higher Order Derivatives	3a. Find the derivatives of given function using standard function formulae. 3b. Find the derivatives of given function using Rules of Derivatives. 3c. Find the derivatives of given composite, inverse and inverse trigonometric , implicit, explicit, parametric, and exponential functions. 3d. Differentiate the given function w.r.t. x by using logarithmic differentiation. 3e. Differentiate the given function w.r.t. another function. 3f. Find the second order	3.1 First principle of derivatives and Notations(without proof), Derivatives of standard function.(LIATE) 3.2 Rules for differentiation (without proof) 3.3 Derivative of composite, inverse and inverse trigonometric , implicit, Explicit, Parametric, and exponential functions. 3.4 Logarithmic differentiation. 3.5 Derivatives of one function with respect to another function 3.6 Second order differentiation.	12

	derivatives of the given function.		
4. Indefinite and Definite Integration	4a. Integrate the give function w.r.t. x 4b. Evaluate the given integral by substitution method. 4c. Evaluate the integral of given composite or rational function. 4d. Integrate the given Trigonometric function. 4e. Integrate the given function by, Integration by Parts or Partial Fraction. 4f. Evaluate the given Definite integral by using properties.	4.1 Concept of Integration as a anti derivatives, Integral of standard function (LIATE) Rules of integration. 4.2 Integration by substitution method. 4.3 Integration of Algebraic Rational function and composite function. 4.4 Integration of trigonometric function. 4.5 Integration by partial fraction and by parts. 4.6 Definite integral and their properties.	10
5. Differential Equations	5a. Find the order and degree of the given D.E. 5b. Form the differential equation by eliminating arbitrary constant. 5c. Solve given differential equations of first order and first degree by variable separable method. 5d. Reduce the given differential equation to variable separable form and solve it. 5e. Identify the given D.E (Homogeneous, Linear, or Bernoulli's) and find its solution.	5.1 Concept of differential equation, Order and degree of differential equation, Formation of differential Equation. 5.2 Methods of solving Differential equation of first order and first Degree. (a) Variable separable Method. (b) Equation reducible to variable separable form. (c) Exact Differential Equation. 5.3 Linear differential equation 5.4 Homogenous differential equation, 5.5 Bernoulli differential equations.	06
6. Laplace Transform and Complex Number	6a. Find the Laplace transform the given function by using standard formulae or by properties. 6b. Find the Laplace transform the given function by using Laplace Transform of Derivatives. 6c. Express the given complex number in the form of $a+ib$, separate it	6.1 Concept of Laplace Transform, standard formulae And Properties. - Linearity property. - First And Second shifting property. - Change of scale property. 6.2 Laplace Transform of Derivatives. - Multiplication by t^n . - Division by t 6.3 Concept of complex number, Algebra of complex number, Equality of complex number. 6.4 Power of i , Argand's Diagram,	08

	into real and imaginary parts. 6d. Find the modulus and amplitude of the given complex number. . 6e. Express the given complex number into Polar form. 6f. Find the root of the given complex number. 6g. Verify the given relation by using Euler's Theorem and DeMoiver's theorem.	Modulus and Amplitude of complex number. 6.5 Polar form of complex number. 6.6 Roots of complex number. 6.7 Power of complex Number (DeMoiver's Theorem) and EULER's Theorem.	
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assign ment	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Find value of any given function.	1. Functions	01
2	Find limits algebraic functions.	2.Limits	01
3	Find limits trigonometric, exponential functions.		01
4	Solve examples on derivative using algebraic operations.	3. Derivatives and Applications of derivative	01
5	To find dy/dx of implicit functions.		01
6	To find dy/dx of parametric functions and inverse trigonometric functions.		01
7	To find the Higher order Derivatives		01
8	Solve examples using rules of integration and substitution method.	4. Integration, Definite integration and Applications	01
9	Solve examples using integration by parts and partial method.		01
10	Solve examples using integration by parts and partial fraction method.		01
11	Evaluate definite integral simple examples.		01
12	Evaluate definite integral using properties.		01
13	Solve D.E. using variable separable method and reducible to variable separable.	5. Differential Equations	01
14	Solve homogenous, linear and Bernoulli D.E.		01
15	Find the modulus and amplitude of the complex number.	6. Complex Number and Laplace Transform	01
16	Solve examples of Laplace Transform.		01

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Functions	02(00)	00(03)	03(00)	05(03)
2	Limits	02(02)	06(00)	00(03)	08(05)
3	Derivatives, Second Order Derivative	02(00)	03(03)	06(03)	11(06)
4	Integration, and Definite Integration	02(02)	9(00)	03(06)	14(06)
5	Differential Equations	04(00)	06(03)	00(03)	10(06)
6	Complex Number and Laplace Transform	00(02)	00(06)	12(00)	12(08)
	Total	12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	2	R	2	3	R	2	4	R	2	4	R	2	6/9
	5	R	2	5	R	2	6	R	2										
2	1	U	3	2	U	3	2	U	3	1	A	3	2	A	3				3/5
3	3	U	3	3	U	3	4	U	3	4	U	3	3	A	3				3/5
4	4	U	3	4	A	3	5	U	3	4	A	3	4	A	3				3/5
5	5	U	3	5	U	3	6	U	3	6	U	3	5	A	3				3/5
6	3	A	6	6	A	6	6	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Who m	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3, 4,5,6
		Class Room Assignm ents		Tutorial Assignme nts	15	--	Assignment Book	1, 2, 3, 4,5,6
	TEE (Term End Examination)	End Exam	Stude nts	End of the Course	60	24	Theory Answer Scripts	1, 2, 3, 4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continu ous Assessm ent of Practical	Students	End of Every Practical	--	--	--	--
		Journal Writing		Assignme nts	--	--	--	--
				Total	--	--		
	TEE (Term End Examination)	End Exam	Stude nts	End of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Stude nts	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of the Course	Questionnaires			

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	-	-	-	-
5	3	-	-	-	-	-	-	-	-	-
6	3	-	-	-	-	-	-	-	--	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Engineering Mathematics	P.N.Wartikar, Pune Vidyarthi Griha Prakashan	4567155742
2	Calculus of one variable	IA Maron, Publisher: Arihant, 5 th edition 2015	9352030559
3	Engineering Mathematics	S.S.Shastry, Prentice Hall Of India, 4 th edition 2008	9788120336162
4	Engineering Mathematics	D.T.Gaikawad, S.Chand Publication, 1 st edition 2010	8121933560
5	Higher Engineering Mathematics	B.S.Grewal, Publisher: S Chand, 43 rd edition 2014	9788174091955

❖ **E-REFERENCES:**<https://msbte.org.in/msbtelectures.html>❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Mr.S.M.Sayyed	I/C HOD, Mathematics Deptt.	Govt. Polytechnic, Nagpur
2	Mr.P.T.Khobaragade	Lecturer	Govt. Polytechnic, Nagpur
3	Mr.G.R.Dewalkar	Lecturer	Govt.Polytechnic,Nagpur
4	Mr.W.T.Gaidhane	Lecturer	Nagar Parishad Jr. College ,Arvi
5	Dr.P.B.Bahatkar	Professor	Y. C. C. E. Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN CE/ME/EE/EC/AE/PK/MT/MC/TX
COURSE CATEGORY	: ENGINEERING SCIENCE COURSE
COURSE CODE	: AM101G
COURSE TITLE	: ENGINEERING MECHANICS
TEACHING SCHEME	: TH:03;TU:00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH= 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TE EXAM	: 03 HRs
PR. TE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

Study of this course develops understanding of effect of force on a body. It helps in analytical and graphical solutions to problem related to forces acting on body. It also helps in understanding concept and application of Equilibrium, friction, centroid and centre of gravity. Study of simple machines gives idea about input, output, efficiency and friction of machine. Study of this course is very useful at higher level like strength of materials, Mechanics of Structure etc. It helps in forming base for understanding all the courses, which are related to engineering mechanics.

❖ COURSE OUTCOMES:

After completing this course students will be able to—

1. Apply concept of Units, Vector and Scalar Quantities.
2. Select the relevant simple lifting machine for given purpose.
3. Apply various theorems to find the resultant of system of forces.
4. Apply law of equilibrium on different bodies.
5. Locate Centre of gravity and Centroid in various sections.
6. Determine concept of friction in various conditions.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Introduction of Engineering Mechanics	1a. Describe given terms related to Engineering Mechanics. 1b. Classify the given units of scalar and vector quantity.	1.1 Significance of engineering mechanics, necessity and Classification of engineering mechanics. 1.2 Definitions: Space, time, particle, body, rigid body, mass, weight, scalar and vector quantity. Units of measurement, fundamental units and derived units.	02
2. Simple Lifting Machine	2a. Describe given terms related to simple lifting machine. 2b. Describe given types of simple lifting machine. 2c. Determine velocity ratios, efficiency and law of various machines on given data.	2.1 Concept of simple lifting machine, uses of machine, definition of load, effort, mechanical advantage, velocity ratio, efficiency of Machines, reversible and non-reversible machines. 2.2 Ideal machine, friction in machine, law of machine, maximum Mechanical advantage and efficiency. 2.3 Velocity ratios of Simple Axle and Wheel, Differential axle wheel, Single Purchase & Double purchase crab winch, Simple Screw Jack, Weston's Differential pulley block, Geared pulley block, Two Sheaves and Three Sheaves pulley block, Worm and Worm wheel.	08
3. Forces	3a. Describe given Terms related to Force . 3b. Identify the given force system and effect of a force. 3c. Resolve the given single force. 3d. Calculate Resolution of force & Composition of forces by using given law on given data. 3e. Calculate Resultant force on the basis of given data by given method.	3.1 Concept of force, definition of force, unit of force, effects of force, Characteristics of force. 3.2 System of forces. Principle of transmissibility of force. 3.3 Composition of forces & Resolution of forces (Two dimensional), Orthogonal and Non Orthogonal components of a force. Resultant force. Resultant of concurrent, non-concurrent and parallel forces, Law of parallelogram of forces: limitations and its applications 3.4 Definition of moment, sign convention of moments, types of moments. Law of moment, definition of couple, types of couple, properties of couple, Varignon's theorem of moment and its application.	12

		3.5 Introduction to graphic statics, graphical representation of force, Bow's notation, Space diagram, force diagram, polar diagram & funicular polygon.	
4. Equilibrium	4a. Describe given terms related to Equilibrium. 4b. Determine unknown force in the given situation using Lami's theorem. 4c. Describe given terms related to Beam, load and supports. 4d. Determine reactions in the given type of beam by given method.	4.1 Equilibrium and Equilibrant. Free body and free body diagram. Analytical and graphical condition of equilibrium 4.2 Lami's Theorem: limitations and its application 4.3 Equilibrium of concurrent, non-concurrent and parallel forces. Beam, span, type of beams, type of supports, types of loading: point load and Uniformly Distributed Load. Analytical and Graphical method to calculate reactions at support for point load and Uniformly Distributed Load on simply supported and overhanging beams	10
5. Centroid & Centre of Gravity	5a. Determine centroids of given plain regular figure. 5b. Calculate centroid of the given compound plain lamina. 5c. Determine the centre of gravity of given solid bodies. 5d. Determine centre of gravity of given compound solids.	5.1 Centroid and centre of gravity, difference between centroid and centre of gravity. Locating centroid of regular figures such as triangle, rectangle, circle, Semi circle, quarter circle.(Formula only) 5.2 Centroid of compound figures, having combination of two different geometric areas only. 5.3 Centre of gravity of solid bodies like cuboid, cylinder, cone, sphere and hemisphere. 5.4 Centre of gravity of compound bodies having combination of only two different geometric shapes.	08
6. Friction	6a. Describe given laws of Friction. 6b. Determine the friction force in the given situation.	6.1 Friction and its importance in engineering, types of friction, laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. 6.2 Equilibrium of bodies on horizontal plane subjected to force parallel and inclined to the plane. Body resting on inclined plane subjected to force parallel to the plane. (Excluding ladder friction).	08

Total Hrs.	48
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B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
Group A (Any 10)			
1	Determine M.A., V.R., Efficiency of and law of machine for simple /Differential Axle and Wheel	Simple Machine lifting	02*
2	Determine M.A., V.R., Efficiency and law of machine for Simple Screw Jack		02*
3	Determine M.A., V.R., Efficiency and law of machine for Two Sheave Or three sheave Pulley Block		02
4	Determine M.A., V.R., Efficiency and law of machine for Single purchase Crab Or Double purchase Crab		02*
5	Determine M.A., V.R., Efficiency and law of machine for Worm and Worm Wheel		02
6	Use Force table to determine resultant of concurrent force system using law of Polygon of forces	Forces	02*
7	Determine Forces in the members of jib crane.		02
8	Apply Lamis theorem to determine unknown force	Equilibrium	02*
9	Determine support reactions for simply supported beam		02
10	Locate the centroid of plane lamina by method of suspension	Centroid and Centre of Gravity	02
11	Determine co-efficient of Friction between different surfaces such as Wood and wood, Wood and glass, Wood and metal.	Friction	02*
Group B			
12	Determine resultant of co-planer concurrent forces by graphical method. (Any two problems)	Force	04
13	Determine resultant of co-planer non-concurrent forces by graphical method. (Any two problems)	Force	04
14	Determine beam reactions for Vertical Point Load and UDL by Graphical method. (Any two problems)	Equilibrium	04
Total Hrs			32

- Experiments marked * are compulsory.
- Minimum 12 Practicals should be performed.
- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction	02(00)	00(00)	00(00)	02(00)
2	Simple Lifting Machine	02(00)	03(03)	03(03)	08(06)
3	Forces	02(02)	06(03)	06(03)	14(08)
4	Equilibrium	02(02)	03(03)	09(03)	14(08)
5	Centroid And Centre Of Gravity	02(00)	03(00)	06(06)	11(06)
6	Friction	02(02)	03(03)	06(03)	11(08)
	Total	12(06)	18(12)	30(18)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	3	R	2	4	R	2	6	R	2										
2	2	U	3	3	U	3	3	U	3	2	U	3	3	U	3				3/5
3	4	U	3	5	U	3	6	U	3	4	U	3	6	U	3				3/5
4	2	A	3	3	A	3	3	A	3	2	A	3	3	A	3				3/5
5	4	A	3	4	A	3	4	A	3	4	A	3	6	A	3				3/5
6	5	A	6	6	A	6	5	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing figure of simple lifting machine and force diagram, selection of equipment. writing procedure etc.	10
2	Performance	10
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	20
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	-	-	-
2	3	3	-	3	-	-	3	-	-
3	3	3	-	3	-	-	3	-	-
4	3	3	-	3	-	-	3	-	-
5	3	3	-	3	-	-	3	-	-
6	3	3	-	3	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Applied Mechanics	R.S. Khurmi, S.Chand & Co. New Delhi, 2014	10:8121916437 13:9788121916431
2	Engineering Mechanics	Sunil Deo, Label Book Publishers New Delhi, 2014	10:9381595550 13:978-9381595558
3	Engineering Mechanics	Basu, Tata Mcgraw Hills, 2013	10:125906266X 13:978-1259062667
4	Engineering Mechanics	S Ramamrutham, S Chand & Co. New Delhi, 2008	8187433515 9788187433514
5	Static and Straight of Materials	U.C. Zindal Asian Book Pvt. Ltd New Delhi, 2008	10:8184120737 13:9788184120730

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=-JG9IEqRzQ4> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=4VIhh6sGkrI> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=EcPGKLUE04I> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=ndT35aqDfAQ> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=W9UDs-kSR0g> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=kuAfu0fZOLw> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=Bx-mMA6k8u4> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=9XtGJXVnQxk> Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=k37FJHbSQA8> Accessed on 18th June 2021
- https://www.youtube.com/watch?v=6_D6jjQcAFU Accessed on 18th June 2021
- <https://www.youtube.com/watch?v=AOkeQMMsSrc> Accessed on 18th June 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Simple /Differential axle and wheel
2. Simple Screw Jack
3. Two Sheave or Three sheave Pulley block
4. Single Purchase crab or double purchase Crab wheel
5. Worm and worm wheel
6. Force table apparatus for law of Polygon of forces
7. Jib crane by using triangle law of forces
8. Lamis theorem Force table apparatus
9. Inclined plane Apparatus

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Mr.Y.K.Chandarana	HOD, Applied Mechanics	Govt. Polytechnic, Nagpur
2	Mr.A.Ateeque Azher	Lecturer in Applied Mechanics	Govt. Polytechnic, Nagpur

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG

COURSE CATEGORY: PROGRAMME CORE COURSE

COURSE CODE : EC101G

COURSE TITLE : BASIC ELECTRONICS

TEACHING SCHEME: TH: 04; TU: 00; PR: 02(CLOCK HRs.)

TOTAL CREDITS : 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TEE EXAM : 03 HRs

PR. TEE EXAM : 02 HRs

PT. EXAM : 01 HR

❖ RATIONALE:

Diploma Engineers deal with the various electronic components while maintaining various electronic devices. It is necessary that students should know the facts, concepts, working principles and fundamentals of circuits used in all electronic circuits. This course describes the basic facts, concepts and working principles for the understanding of various circuits which are used in different Electronics applications. It is very useful course for understanding basic electronic devices, their ratings and applications.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Plot V-I characteristics of various semiconductor diodes.
2. Develop rectifier and filter circuits.
3. Use transistor as amplifier and switch.
4. Select correct biasing method according to application.
5. Analyze single stage amplifier circuit.
6. Plot characteristics of FET and MOSFET.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Semiconductor Theory and Semiconductor Diodes	1a. Justify the importance of Electronics. 1b. Differentiate between different types of materials. 1c. Describe electron mobility in conductor and semiconductor. 1d. Describe crystalline structure of given type of semiconductor material. 1e. Describe the effect of temperature on conductivity of given material. 1f. Analyze Forward and reverse V-I characteristic of different diodes. 1g. Select diode according to applications. 1h. Compare different types of breakdown. 1i. Use Zener Diode as a voltage Regulator.	1.1 Definition and importance of Electronics, Electronics system model (Input process output), Units and scales related to Electronics 1.2 Types of materials with energy level diagrams:- conductor, insulator and semiconductors 1.3 Electron mobility in conductor, Emission of Electron from metal 1.4 Commonly used semiconductor - Germanium, Silicon. Intrinsic semiconductor, Extrinsic semiconductors, P-type and N-type semiconductors 1.5 Effect of temperature on conductivity of metal and semiconductor 1.6 PN junction, Formation of PN junction, Forward and reverse biasing, V-I characteristic of PN junction diode, Specifications of diode 1.7 Working of various diodes with their applications- PIN diodes, Varactor diodes, Tunnel diodes, LED, Photodiode 1.8 Types of reverse breakdown- Zener and Avalanche breakdown and their comparison 1.9 Principle of operation, characteristics, specifications and applications of Zener diode, Zener diode as a voltage regulator	16
2. Applications of Diode and Filter Circuits	2a. Classify different rectifier circuits. 2b. Analyze the output waveforms of given rectifier circuit. 2c. Describe given parameter of rectifier circuit. 2d. Compare half and full wave rectifier on basis of given	2.1 Definition and types of rectifier 2.2 Circuit details, operating principle, working, advantages and disadvantages of half wave, center-tapped full wave rectifiers and bridge rectifier. 2.3 Definition of peak inverse voltage (PIV), ripple factor, form factor, rectification	12

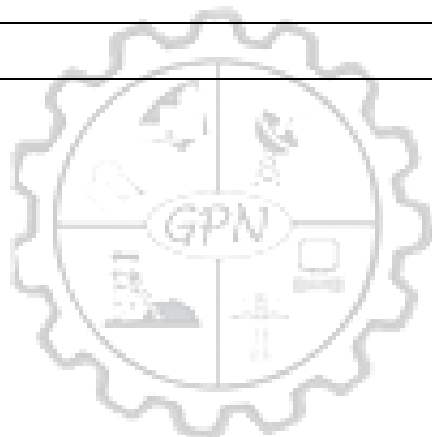
	parameter. 2e. Use different types of filter circuit. 2f. Describe the use of diode in wave shaping circuit.	efficiency and transformer utilization factor (TUF) 2.4 Comparison of half and full wave rectifier 2.5 Necessity of filters and types of filter, Circuit diagram, operating principle and output waveforms of series inductor, shunt capacitor, chock input (LC), CLC (PI) filter. 2.6 Introduction to Clippers and Clamper circuits	
3. Bipolar Junction Transistor	3a. Describe working of given transistor with neat diagram. 3b. Draw given transistor configuration circuit diagram. 3c. Plot input and output characteristics of CB and CE transistor configuration. 3d. Describe given parameter or specification related to transistor. 3e. Use transistor as switch or amplifier. 3f. Compare CB, CE, CC circuits.	3.1 Symbol, Structure, Construction and operating principle of PNP and NPN transistor 3.2 CB, CE and CC transistor configuration 3.3 Input and output characteristics of transistor in CB and CE configuration 3.4 Definition of transistor parameters: Input resistance, output resistance, current gains alpha and beta. Relation between current gains (Alpha and Beta), leakage currents. Specifications of transistors- V_{CEsat}, I_{Cmax}, V_{CEO}, I_{CEO}, V_{CE} breakdown, power dissipation 3.5 Applications of transistor as a switch and amplifier 3.6 Comparison of CB, CE and CC, Advantages of CE configuration	14
4. Transistor Biasing and Stabilization	4a. Describe the concept of transistor biasing and stabilization. 4b. Justify the use of given load line to set the operating point. . 4c. Analyze given biasing circuit.	4.1 Definitions of Faithful amplification, Transistor biasing and Stabilization 4.2 DC load line, AC load line, Operating Point 4.3 Methods of transistor biasing circuits and explanation – i) Fixed bias ii) Collector to base bias resistor iii) Base bias with emitter feedback iv) Voltage divider bias	12

5. BJT Amplifier	5a. Classify different amplifiers. 5b. Describe given term related to amplifier. 5c. Analyze the single stage common emitter Amplifier.	5.1 Classification of amplifiers, Single stage BJT amplifier in CE configuration 5.2 Definition of gain, voltage gain, current gain, power gain, decibel gain, bandwidth 5.3 Frequency response of single stage CE amplifier	04
6. Field Effect Transistor	6a. Classify FET. 6b. Plot the drain and transfer characteristics of given JFET. 6c. Describe given parameter related to JFET. 6d. Find the relation between given JFET parameters. 6e. Describe the characteristics of given MOSFET. 6f. Compare of BJT, JFET and MOSFET.	6.1 Classification of FET. 6.2 Construction, symbol, operating principle, characteristics, specifications, advantages and applications of P-channel and N-channel JFET 6.3 Definition of pinch-off voltage, cutoff voltage, transconductance, amplification factors. 6.4 Relation between JFET parameters- amplification factor, drain resistance, transconductance. 6.5 Construction, symbols, operating principle and characteristics of depletion type and enhancement type MOSFET. 6.6 Comparison of BJT, JFET and MOSFET.	06
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	i) Set the proper voltage and current limits with controls in regulated power supply. ii) Measure voltage and currents using multimeter.		02
2	Measure V_{pp} (Peak to Peak Voltage) and Frequency for different waveforms generated from function generator on CRO.		02
3	Plot V-I characteristics of P-N junction diode and find the value of cut-in voltage. Calculate the static and dynamic resistance.	1. Semiconductor Theory and Semiconductor Diodes	02
4	Assemble and analyze the circuit of Zener diode as a voltage regulator.		02

5	Observe and draw the input and output waveforms of Half-wave rectifier. Find the RMS voltage and average DC voltage.	2. Applications of Diode and Filter Circuits	02
6	Observe and draw the input and output waveforms of Full wave center tap rectifier. Find the RMS voltage and average DC voltage.		02
7	Measure and compare the average DC voltage of Bridge rectifier with and without capacitor filter.		02
8	Plot the input and output characteristics of transistor in CE configuration.	3. Bipolar Junction Transistor	04
9	Assemble fixed bias circuits on breadboard and measure different parameters.	4. Transistor Biasing And Stabilization	04
10	Assemble voltage divider biasing circuit on breadboard and measure different parameters.		04
11	Plot the frequency response a single stage common emitter amplifier and find the bandwidth.	5. BJT Amplifier	02
12	Plot the drain characteristics of JFET.	6. Field Effect Transistor	04
Total Hrs.			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Semiconductor Theory and Semiconductor Diodes	02(02)	06(03)	00(03)	08(08)
2	Applications of Diode and Filter Circuits	02(00)	06(06)	06(00)	14(06)
3	Bipolar Junction Transistor	02(02)	06(06)	06(00)	14(08)
4	Transistor Biasing and Stabilization	02(00)	03(03)	06(00)	11(03)
5	BJT Amplifier	02(00)	03(00)	00(03)	05(03)
6	Field Effect Transistor	02(02)	06(00)	00(06)	08(08)
	Total	12(06)	30(18)	18(12)	60(36)

R – Remember

U - Understand

A - Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	3	R	2	6	R	2										
2	1	U	3	1	U	3	4	U	3	1	U	3	4	U	3				3/5
3	2	U	3	2	U	3	5	U	3	2	U	3	2	U	3				3/5
4	3	U	3	3	U	3	6	U	3	3	U	3	3	U	3				3/5
5	6	U	3	6	A	3	6	A	3	1	A	3	5	A	3				3/5
6	2	A	6	3	A	6	4	A	6										2/3

T- Unit/Topic Number

L- Level of Question

M-Marks

R-Remember

U-Understand

A-Analyze/Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Sheets	1, 2, 3, 4, 5, 6
		Assignments		Continuous	15	--	Assignment Book / Sheet	1, 2, 3, 4, 5, 6
	TE E (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Sheets	1, 2, 3, 4, 5, 6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Rubrics &Assessment Sheets	1, 2, 3, 4, 5, 6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3, 4, 5, 6
				Total	25	10		
	TE E (Term End Exam)	End Exam	Students	End of the Course	25	10	Rubrics & Practical Answer Sheets	1, 2, 3, 4, 5, 6
Indirect Assessment	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4, 5, 6	
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva-voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	-	-	3	-	-	-	-	-
2	3	2	-	-	-	2	-	-	-
3	3	-	-	-	-	2	1	-	1
4	3	-	-	3	-	-	-	-	-
5	3	2	-	3	-	-	-	-	-
6	3	-	-	3	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXTBOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Principles of Electronics	V. K. Mehta, S. Chand & Company Ltd., Reprint, 1996	8121910536
2	Electronic Principles	A.P. Malvino, Tata McGraw Hill, 8 th edition	9780073373881
3	Applied Electronics	R. S. Sedha, S. Chand & Co, revised edition, 2013	8121927838, 9788121927833
4	Basic Electronics	Grob, Tata McGraw Hill, 12 th edition	0073510859
5	Electronics Devices and Circuits	S Salivahanan, Tata McGraw Hill, 2 nd edition 2011	0074633864, 9780074633861
6	Electronics Devices and Circuit Theory	Boylestead Robert, Louis Neshelsky Pearson Publication	9788131727003
7	Basic Electronic Engineering	Baru V., Kaduskar R., Gaikwad S. T., Dreamtech Textbooks	9789350040126

❖ **E-REFERENCES:**

- www.nptel.ac.in accessed on 13th July 2021
- <http://vlabs.iitkgp.ac.in/be/> accessed on 13th July 2021
- <https://www.learnelectronicsonline.com/> accessed on 13th July 2021
- <http://www.instructables.com/id/Basic-Electronics> accessed on 13th July 2021
- <https://learnabout-electronics.org/> accessed on 13th July 2021
- <http://www.datasheetcafe.com/> accessed on 13th July 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Ammeter- 0-20 μ A, 0-50 μ A, 0-100 μ A, 0-200 μ A, 0-5 A, 0-10 A
2. Voltmeter- 0-5V, 0-15 V, 0-30 V, 0-100 V
3. Digital Multi-meter
4. Cathode ray oscilloscope- 0 to 30MHz
5. Function Generator-0-5MHz.
6. Regulated Power Supply - 0-30 V

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.V. H. Mankar	Head of Electronics & Telecommunication Engineering	Government Polytechnic, Nagpur
2	Dr. R. V. Yenkar	Head of Electronics & Telecommunication Engineering	Government Polytechnic, Nagpur
3	Prof. N. V. Chide	Lecturer in Electronics & Telecommunication Engineering	Government Polytechnic, Nagpur
4	Prof. U. P. Potdar	Lecturer in Electronics & Telecommunication Engineering	Government Polytechnic, Nagpur
5	Shri. S. V. Darwhekar	Director , Beta Computronics Pvt. Ltd.	Beta Computronics Pvt. Ltd.
6	Prof. Gazala Ali	Head of Electronics Engineering	Anjuman Polytechnic, Nagpur
7	Prof. Kapil Pachpor	Lecturer in Electronics Engineering	Government Polytechnic, Amravati

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC102G
COURSE TITLE	: ELECTRONIC MATERIAL AND COMPONENTS**
TEACHING SCHEME	: TH: 03; TU: 00; PR: 02(CLOCK Hrs.)
TOTAL CREDITS	: 04(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs (Objective Type Online Examination)
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 30 Minutes (Objective Type Offline Examination)

❖ **RATIONALE:**

The main objective of this course is to impart knowledge of different electronics materials and various components used in electronics industries. This course also describes suitability and characteristics of various electronics components for different applications.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Identify the Conducting material from its specification.
2. Select the different dielectric material for various applications.
3. Use different magnetic material for various applications.
4. Identify and test Electronic passive components.
5. Select the electronics components for different applications.
6. Test cables and connectors.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Conductors	1a. Compare various high conductivity material base on given points. 1b. Select the relevant solder for given application. 1c. Identify the given material on the basis of relative permittivity.	1.1 Properties/Specification and applications of High conductivity materials: Copper, Aluminum, Silver, Platinum 1.2 Properties/Specification and applications of Soft solders and hard solders, Difference between hard and soft solder. Definition of Flux, Use of Fluxes 1.3 Superconductors, Properties and applications of superconducting materials: Mercury	06
2. Dielectric Materials	2a. Identify different dielectric material basis on given point. 2b. State various terms related to dielectric material. 2c. Select the dielectric material for given application.	2.1 Properties and requirement of good Dielectric Material 2.2 Definitions: Dielectric constant, Dielectric loss, Breakdown strength 2.3 Types of Dielectric Material: Solid, Liquid and Gaseous Breakdown of solid, liquid & gaseous insulating materials. Dielectrics used in transformer.	06
3. Magnetic Materials, Microphones, Speakers	3a. Identify magnetic materials on the basis of given point. 3b. Select the Microphone for given applications. 3c. Select the Loudspeaker for given applications.	3.1 Definition of Permeability. Classification and comparisons of Diamagnetic, Paramagnetic Ferromagnetic material 3.2 Definition of Microphone, Construction and working of Carbon microphone, ribbon microphones. 3.3 Definition of Speaker. Construction and working of horn Loudspeaker.	08
4. Passive Components	4a. Identify different resistor from is constructional diagram. 4b. Select capacitor for given applications.	4.1 Resistors 4.1.1 Classification of resistors, Construction and application of Carbon composition, carbon film	10

	4c. Classify Inductor on given point. 4d. Test all passive components.	and wire wound resistors. 4.1.2 Construction and application of LDR, Thermistors, Rheostat, Potentiometer. 4.1.3 Color coding of resistors. (Numerals on color coding) 4.2 Capacitor 4.2.1 Classification of capacitor. 4.2.2 Construction and application of paper, ceramics, Plastic capacitors and Trimmer. 4.3 Inductors. 4.3.1 Definition, Classification 4.3.2 Function of Iron core inductor and Air core Inductor 4.3.3 Applications 4.4 Testing of Passive Components	
5. Switches, Relays and Displays	5a. Identify different Switches for give application. 5b. Select relay for relevant applications. 5c. Compare displays devices on given point. 5d. Test the electronics component. 5e. Identify different surface mount devices.	5.1 Switches 5.1.1 Symbol and application of SPST, SPDT, DPST, DPDT switches. 5.1.2 Constructional diagram, operation and application of Toggle, rotary, DIP, Thumbwheel Switch. Fuses, Necessity of fuses in electronic devices. 5.2 Relays Working principle and constructional diagram of electromagnetic relay, Dry reed relay, and Mercury wetted relay. Specification, application. 5.3 Displays Classification of displays, Operation and constructional diagram of LED, LCD& Dot matrix display. Advantages, disadvantages, Applications of display. Comparisons of LED and LCD 5.4 Testing of Relay and Switch 5.5 Introduction of Surface Mount Technology	10
6. Cable and Connectors	6a. Identify different types of wires for given applications. 6b. Select cable for different applications. 6c. Describe different	6.1 Definition of Wire, Materials used for making wire, Types of wires-single stranded and, Multi stranded wire, Uses of wire. 6.2 Cables: Types of cables-Operation, constructional diagram and	08

	connectors with construction 6d. Test cable and connector for different used.	application of coaxial, Twin core cables, twisted pair cables, R.F. cables, Ribbon cable and Optical fiber cable. 6.3 Connectors Types of connectors. Operation, constructional diagram and applications of Audio, R.F, UHF, BNC, TNC connectors. 6.4 Testing of cables and connectors.	
Total Hrs.			48

B.LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Collect the information of Different High conductivity material with its specification	Conductor	04
2	Collect the information of Different Dielectric material.	Dielectric Material	04
3	Collect specifications of Loudspeaker for different types.	Magnetic material, Microphones, Speakers	04
4	Collect specifications of microphones for different types.		02
5	Measure value of resistor using Multimeter, compare with the value calculated by color code.	Passive component	02
6	Measure value of capacitor and inductor with the help of LCRQ Meter		02
7	Test LED using Multimeter.		02
8	Identify different terminals of 7 segment LED display and display numerical value by connecting to the power supply	Switches, Relays and Displays	02
9	Test different types of switches using Multimeter.		02
10	Test Relay with the help of Multimeter		02
11	Test Cables & connector for conductivity.	Cables and Connectors	02
12	Micro Project		04
Total Hrs			32

SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Conductor	02(00)	04(00)	00(00)	06(00)
2	Dielectric Material	02(00)	06(02)	00(00)	08(02)
3	Magnetic materials, Microphones, Speakers	04(00)	06(02)	00(00)	10(02)
4	Passive components	02(00)	04(00)	06(02)	12(02)
5	Switches, Relays and Display	02(00)	04(02)	06(00)	12(02)
6	Cables and connectors	06(02)	06(00)	00(00)	12(02)
	Total	18(02)	30(06)	12(02)	60(10)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T-Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Options
1 To 35	1	R	2	1	U	2	1	U	2	2	R	2	2	U	2	30/35
	2	U	2	2	U	2	2	U	2	3	R	2	3	R	2	
	3	U	2	3	U	2	3	U	2	3	U	2	4	R	2	
	4	U	2	4	U	2	4	A	2	4	A	2	4	A	2	
	4	A	2	5	R	2	5	U	2	5	U	2	5	U	2	
	5	A	2	5	A	2	5	A	2	6	R	2	6	R	2	
	6	R	2	6	R	2	6	U	2	6	U	2	6	U	2	

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	2	-	-	-	-	-	-	-	-
2	-	2	3	-	-	-	-	-	-
3	-	3	3	-	-	-	-	-	-
4	-	3	3	2	-	-	-	3	2
5	-	3	3	2	-	-	-	3	3
6	-	3	3	2	-	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXTBOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Electronics Material & Components	Madhuri Joshi, SPD Publisher, Third Edition, 1 January 2004	8173669007
2	Encapsulation of Electronic Devices & Component	Edward R. Salmon, CRC Press, 1st edition, 31 October 1986	978-0-8247-7589-
3	Electrical & Electronic Engineering Materials & Components.	S.K. Bhattacharya, KHANNA Publisher, first edition, 1996	978-93-87394-24-7

❖ **E-REFERENCES:**

- <https://www.learnelectronicsonline.com/> accessed on 22nd July, 2021.
- <https://www.instructables.com/Basic-Electronics/> accessed on 22nd July, 2021.
- <https://www.codrey.com/electrical/difference-between-relay-and-switch> accessed on 22nd July, 2021.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. LCR Q meter
2. Digital Multi-meter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	HOD(II), Electronics & Telecomm Engg. Deptt.	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	HOD(I), Electronics & Telecomm Engg. Deptt.	Government Polytechnic, Nagpur.
3	Prof. P. H. Gedam	Lecturer, Electronics & Telecomm Engg. Deptt.	Government Polytechnic, Nagpur
4	Prof. A.S. Aghav	Lecturer, Electronics & Telecomm Engg. Deptt.	Government Polytechnic, Nagpur
5	Shri.Sandip Darwekar	Director, Beta Computronics Pvt. Ltd. Nagpur	Industry Expert
6	Mrs.Gazala Ali	HOD, Electronics Anjuman Polytechnic Nagpur	Member from Academics (External)
7	Prof. Kapil Pochpor	Lecturer in Electronics & Govt. Polytechnic Amravati	MSBTE Nominee

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN EC, CM, IT,AI ML
COURSE CATEGORY	: ENGINEERING SCIENCE COURSE
COURSE CODE	: EE101G
COURSE TITLE	: BASIC OF ELECTRICAL ENGINEERING
TEACHING SCHEME	: TH: 03; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ **RATIONALE:**

Knowledge of electrical engineering is essential for the students of Electronics/ Computer/ Information technology. As they have to work in different engineering fields and deal with various types of electrical machines and equipment. Students should know the facts, concepts, principles and procedures in electrical engineering. This course describes the basic facts, concepts & principles for the understanding of basic elementary knowledge related to electrical area. It is very useful course for Solving & understanding the different electrical and electronic circuits.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Follow the electrical safety precautions.
2. Use principles of magnetic circuits.
3. Solve the electrical circuits by using principle and basic laws.
4. Select relevant type of transformers and motors for a given application.
5. Connect electrical measuring instruments in the circuit.
6. Use relevant protective devices/switchgear for different requirements.

❖ **COURSE DETAILS:**
A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Electrostatics & Electromagnetism	1a. Define terms related to electrostatics. 1b. Observe charging and discharging of capacitor. 1c. Solve series, parallel capacitive circuits. 1d. Apply laws of Electromagnetism. 1e. Apply Fleming's right hand rule and Lenz's law to determine direction of induced EMF in a given circuit.	1.1 Capacitance, dielectric constant, capacitance of parallel plate capacitor, capacitance in series and parallel and source of capacitance in electrical systems. 1.2 Charging & discharging of capacitor, Dielectric loss. Types of capacitors and their application. 1.3 Faraday's Laws of electromagnetic induction. Direction of induced EMF and current, Lenz's Law, Fleming's right hand rule, Induced EMF, dynamically induced EMF, statically induced EMF, self- Inductance (L), Mutual Inductance.	08
2. Fundamentals of Electricity	2a. Define the various electrical Parameters. 2b. State Law of resistance and explain Effect of temperature on resistance. 2c. Calculate the temperature coefficient of resistance. 2d. Solve series, parallel and series- parallel resistive circuits. 2e. State KCL and KVL 2f. Define work, power, and energy. 2g. Connect ammeter, voltmeter and wattmeter in an electric circuit. 2h. Compare between AC and DC supply. 2i. Maintenance of Battery	2.1 Concept of electric charge, current, voltage drop, EMF, potential difference, Direction of current and their SI units. 2.2 Resistance, unit of resistance, Law of resistance (Factors affecting resistance), Effect of temperature on resistance, Ohms law 2.3 Resistance in series and parallel, properties of series circuit and parallel circuit,, voltage distribution in series circuit, Current distribution in parallel circuit equivalent resistance of series circuit, equivalent resistance of parallel circuit Applications of series circuits, and parallel circuits, (Numerical based on 2.2 & 2.3) 2.4 Kirchhoff's current and voltage law (no Numerical) 2.5 Work, power, energy and their SI units, Relation between H.P and watts, Kwh and Kcal. 2.6 Connection of ammeter, voltmeter, and wattmeter in single phase AC circuit. and its measurement. 2.7 Concept of AC and DC supply Comparison between AC and DC supply	12

		2.8 Concept of Battery and Cell , Types of battery and their applications	
3. AC Fundamentals	3a. Describe generation of alternating voltage- single phase and three- phase. 3b. Define terms related to AC fundamentals. 3c. Compare terms time period and frequency, angular velocity and frequency, frequency and speed. 3d. Define Maximum, average and R.M.S. value of sinusoidal waveform, form factor and peak factor. 3e. Explain the response of given purely resistive, inductive and capacitive AC circuit with sketches. 3f. Solve problems related to pure resistive, inductive and capacitive circuit. 3g. Understand the concept of reactance, impedance and power factor. 3h. State types of electrical loads.	3.1 Generation of alternating voltage- single phase and three- phase. 3.2 Equation of sinusoidal alternating voltage and current, important terminology such as- waveform, instantaneous value, cycle, time period, frequency, amplitude, Relation between time period and frequency, angular velocity and frequency, frequency and speed. 3.3 Maximum, average and R.M.S. value of sinusoidal waveform, form factor and peak factor. (No derivation) 3.4 A.C. Voltage applied to pure resistor, pure inductor, and pure capacitor. Concept of reactance, Impedance and power factor, power in single-phase circuits. (Simple Numerical problem based on 3.4). 3.5 Types of loads	08
4. Transformer	4a. Explain the construction and working principle of transformer. 4b. Describe the concept of transformation ratio, KVA rating of transformer. 4c. Classify the different types of transformers. 4d. Explain Auto transformer with diagram. 4e. Solve problems related to voltage ratio, current ratio, and transformation ratio.	4.1 Transformer:-Definition, principle of operation, construction, types of transformer, 4.2 EMF equation (No derivation), voltage ratio, current ratio, and transformation ratio 4.3 KVA rating of transformer, (Simple Numerical problem based on 4.2 and 4.3 topic). 4.4 Auto-transformer –Special features, Schematic diagram and its applications.	05

5. AC and DC Motors	5a. Classify different types of AC & DC motors. 5b. Select relevant type of DC motor for a given application. 5c. Describe construction and working of DC motor. 5d. Select relevant type of AC motor for a given application 5e. State application of universal motor 5f. Explain principle of operation of Stepper motor with application. 5g. Explain the concept of reversal of direction of rotation in AC motor an DC motor.	5.1 Classification of A.C & D.C motors. 5.2 DC Motor-construction, parts its function and material used, working principle of D. C. motor. Types - shunt, series and compound motor. Application of DC shunt, series and compound motor, reversal of rotation. 5.3 AC Motor -Single-phase induction motors, principle of operation and application – Split phase IM, Capacitor star induction run, capacitor start capacitor run . 5.4 Universal motor:- Principle of operation , reversal of direction of rotation and application. 5.5 Principle of operation of Stepper Motor and its application. (No Numerical)	10
6. Electrical Safety and Protective Device	6a. Recall electrical safety rules. 6b. Interpret electrical safety signs and symbols. 6c. State the need of earthing. 6d. Describe the features of the given type of protective device. 6e. Select the relevant protective device for the given application with justification.	6.1 Electrical Safety, Causes of accidents, General safety rules, Concept of electrical shock, Effect of electric shock, Method of removing electrocuted person, Safety signs and symbols. 6.2 Earthing- Necessity of earthing, methods of reducing earth resistance. 6.3 Fuse : Operation and types 6.4 MCB, MCCB and ELCB: Operation and general specification.	05
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify electrical measuring instruments, sources, ICDP/ITDP, switches, loads, wires and execute safety precautions in laboratory.	Electrical Safety and Protective device	04
2	Connect voltmeter, ammeter and wattmeter in electrical circuit.	Fundamentals of Electricity	02
3	Measure the current, voltage and resistance with the help of multi-meter or tong tester.		02
4	Calculate the unknown resistance in an electric circuit using ohms law.		02
5	Calculate the temperature coefficient of resistance of conductors.		02
6	Measure the total resistance of series circuit .		02
7	Measure the total resistance of parallel circuit.		02
8	Find the branch current and mesh voltage using Kirchhoff's law (KCL & KVL).		04
9	Use test lamps for testing single-phase and three – phase supply. Use of tester on single-phase supply.		02
10	Operate CRO and Observe the current & voltage wave form for purely R,L& C ac circuit &interpret the phasor relationship.	AC Fundamentals	02
11	Calculate voltage & current ratio of single- phase transformer.	Transformer	04
12	Reverse the direction of rotation of DC shunt motor.	AC and DC Motors	02
13	Reverse the direction of rotation of single-phase capacitor start motor.		02
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Electrostatics& Electromagnetism	02(02)	06(03)	00(00)	08(05)
2	Fundamentals of electricity	05(02)	06(06)	00(00)	11(08)
3	AC Fundamentals	02(00)	09(03)	00(06)	11(09)
4	Transformer	05(02)	03(03)	00(00)	08(05)
5	Drives	04(00)	03(06)	06(00)	13(06)
6	Electrical Safety and Protective device	00(00)	03(03)	06(00)	09(03)
	Total	18(06)	30(24)	12 (06)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	5	R	2	6/9
	2	R	2	1	R	2	4	R	2										
2	1	U	3	2	R	3	2	U	3	1	U	3	4	U	3				3/5
3	1	U	3	4	R	3	3	U	3	2	U	3	5	U	3				3/5
4	2	U	3	3	U	3	5	U	3	3	U	3	6	U	3				3/5
5	6	U	3	3	U	3	4	U	3	5	U	3	2	U	3				3/5
6	6	A	6	5	A	6	3	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assign-ments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assign-ments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of the Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	3	2	2
2	3	-	2	-	-	-	2	-	-
3	3	3	2	-	-	-	2	-	-
4	3	2	2	3	-	-	2	3	3
5	3	-	-	2	-	-	2	3	2
6	3	2	2	-	2	-	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Principle of Electrical Engineering and Electronics	V. K. Mehta, S. Chand & Company Ltd., Reprint, 1996	81-219-1053-6
2	A Text Book Of Electrical Technology Vol-I	B. L. Theraja , A. K. Theraja , S.Chand& Co Ltd., Reprint,2006	81-219-2440-5
3	Basic Electrical Engineering	V. N. Mittle, Arvind Mittal, The McGraw Hill Education Pvt. Ltd, Reprint, 2011	13: 978-0-07-059357-2
4	Experiments in Basic Electrical Engineering	S. K. Bhattacharya and K. M. Rastogi., New Age International Publisher, Reprint, 2009.	978-81-224-1042-6
5	A Text Book on laboratory courses in Electrical Engineering	S.G.Tarnekar and P. K. Kharbanda, S. Chand& Company Ltd., Third, 1990	13: 978-8121901048

❖ **E-REFERENCES:**

- <https://nptel.ac.in/courses/108/108/108108076/> , accessed on 21st June 2021
- <http://www.electrical4u.com> , accessed on 21st June 2021
- <https://www.scribd.com/document/314848295/Lecture-Notes-Basic-Electrical-and-Electronics-Engineering-Notes> accessed on 21st June 2021
- <https://nptel.ac.in/courses/108/108/108108076/> , accessed on 21st June 2021.
- <https://electricalnotes.wordpress.com/articals/> accessed on 21st June 2021.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Meters: Ammeter MI 0-5-10 A, Voltmeter MI 0-150-300, Wattmeter 0-3000 W, Digital Multi-meter, Tong tester, Megger 500V/1000V Hand driven.
2. Rheostat assorted sizes, Variable Inductor, Capacitor
3. Single phase induction motor, 230 V, 50 Hz, 1 kw
4. Single phase transformer, 230/115 V, 50 Hz., 1 KVA
5. CRO, dual trace
6. DC Shunt Motor, 220 V, 3 HP

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.D.D.Lulekar	Chairman , PBOS & HOD Electrical Engg.Deptt.	Government Polytechnic, Nagpur.
2	Mrs A.A.Alegaonkar	CDC Coordinator & Lecturer , Electrical Engg.Deptt.	Government Polytechnic, Nagpur
3	Ms. P. S. Rithe	Expert & Lecturer in Electrical Engg. Deptt	Government Polytechnic, Nagpur.
4	Shri.M.N.Gawande	Expert & Lecturer in Electrical Engg.Deptt	Government Polytechnic, Nagpur
5	Mrs.A.P.Gandhi	Expert & Lecturer in Electrical Engg.Deptt	Government Polytechnic, Nagpur
6	Mrs.P.M.Sonwane	Expert & Lecturer in Electrical Engg.Deptt	Government Polytechnic, Nagpur

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN AI,MC,CE,ME,EE,EC,PK,MT, IT,AU,CM,TX,TR
COURSE CATEGORY	: HUMANITIES & SOCIAL SCIENCE COURSE
COURSE CODE	: EN151G
COURSE TITLE	: BUSINESS COMMUNICATION
TEACHING SCHEME	: TH: 01 TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: 02 HRs
PT. EXAM	: --

❖ RATIONALE:

In this current dynamically evolving scenario, competence in communication skills is one of the requirements of industry from technical students. A diploma holder is expected to interact effectively and efficiently with his peers, superiors, subordinates and clients. Business Communication will prepare him to take on the task of effective communication with ease.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Exhibit appropriate communication skills as required
2. Converse skillfully using modes of communication
3. Prepare and present business communication formats effectively
4. Perform coordinated activities within and outside organization
5. Draft business correspondence with minimal errors

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Communication	1a. Apply modern concept of communication. 1b. Identify & Overcome barriers to communicate effectively. 1c. Use appropriate body language.	1.1 Definition, Process, Types: Verbal-Non-Verbal, Formal-Informal, Upward-Downward, Horizontal. 1.2 Barriers of communication: Physical, Mechanical, Psychological, Language, Status. Ways to overcome barriers.	03
2. Communication in Practice	2a. Identify strengths and weakness of self. 2b. Classify different types of Communication and use it effectively. 2c. Plan & perform effective presentations. 2d. Modify intrinsic qualities.	2.1 Non-verbal communication in detail: Body language, Eye contact, Dress and appearance, color, sound, Gestures, Postures, Pictorial representations. (Maps, Charts, Graphs) 2.2 Nonverbal Codes 2.3 Presentation skills – Parameters, Appearance, use of body language, Eye contact, content preparation, Depiction of interest of audience 2.4 SWOT analysis 2.5 Brain Storming	06
3. Business Correspondence	3a. Identify various types of written communication in business situation. 3b. Apply the appropriate correspondence to the situation.	3.1 Letters: Job application and Resume writing Leave letter, Enquiry letter. 3.2 Circular, Notices, Agenda, Minutes, Email messages.	07
		Total Hrs.	16

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Describe Types of Communication.	Communication	04
2	Conduct Self SWOT analysis.	Communication in practice.	02
3	Outline an Introduction for Self & others.	Communication	04
4	Practice the art of LSRW (to be performed in Language lab using software).	Communication in practice.	06
5	Exhibit Professional Etiquettes.	Communication in practice.	02
6	Prepare Job Application.	Business Correspondence.	02
7	Prepare Resume.	Business Correspondence.	02
8	Demonstrate various types of Business Letters.	Business Correspondence.	02
9	Participate in Brain Storming.	Communication in practice	02
10	Practice Email Writing.	Business Correspondence.	02
11	Master the skill of oral presentation by presenting a topic through PowerPoint presentation.	Communication in practice.	02
12	Implement the art of writing Formal drafting by preparing resume & letters.	Business Correspondence.	02
Total Hrs.			32

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)			Test Answer Sheet	
		Class Room Assignments		Assignments			Assignment Book	
	TEE (Term End Examination)	End Exam	Students	End of the Course			Theory Answer Sheets	
				Total				
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Practical Answer Sheets	1.2.3.4.5
		Journal Writing		Assignments	05	--	Journal	1.2.3.4.5
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	25	10	Practical Answer Sheets	1.2.3.4.5
Indirect Assessment	Student Feedback on Course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5
	End of Course			End of the Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Performance	10
2	Overall presentation of given assignment	10
3	Viva voce	20
4	Activity	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	-	-	-	3	-				
2	3	-	-	-	3	-	2			
3	-	-	-	-	-	3	-			
4	-	-	-	-	-	3	2			
5	-	-	-	-	-	3	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Professional Communication skills	S.R.Pravin, S.Chand Publications	81-219-2092-02
2	Developing Communication skills	Macmillan Publications, Revised Edition, 2011	0333929195
3	Business communication and soft skills.	G.S.R.K Babu Rao, Himalaya Publication, First Edition, 2009	978-81-8488-596-5
4	Secret of face-to-face communication.	Peter Urs, Bender, Macmillan Publication	0333937139
5	Technical communication principles and practices	Meenakshi Raman, Prakash Singh, Oxford University Press,	0-19-567695-5
6	Effective English Communication	Krishna Mohan, Raman Tata Mc Graw Hills,	13978-0-19-566804-9
7	Modern Commercial Correspondence	R.S.Pillai, Bhagwati, S.Chand & Co.	812190519-2

❖ **E-REFERENCES:**

1. https://en.wikipedia.org/wiki/Business_communication, accessed on 29th July 2021
2. <https://www.indeed.com/career-advice/career-development/types-of-business-letters> , accessed on 29th July 2021
3. <https://in.indeed.com/career-advice/resumes-cover-letters/communication-skills> , accessed on 29th July 2021
4. <https://www.youtube.com/watch?v=jaxgeXPgAz0> , accessed on 29th July 2021

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.Rupali Londhe	Lecturer in English & Coordinator	Government Polytechnic, Nagpur.
2	Prof. Nitin Pote	Expert, Lecturer in English	Government Polytechnic, Bramhapuri
3	Prof. Ravindra Suryawanshi	Expert, Lecturer in English	NIT Polytechnic, Nagpur
4	Prof.Nitin Pathak	Expert, Lecturer in English	Kamptee Polytechnic, Nagpur
5	Dr.M.M.Machale	Lecturer in English	Government Polytechnic, Nagpur.
6	Mrs.Kamala Grace	Visiting Lecturer in English	Government Polytechnic, Nagpur.
7	Mrs.Swati Mahatme	Visiting Lecturer in English	Government Polytechnic, Nagpur.
8	Ms.Rasika Joshi	Visiting Lecturer in English	Government Polytechnic, Nagpur.
9	Mrs.Barnali Roy	Visiting Lecturer in English	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : **DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/PK/MT/TX/**
TR/MC/AI

COURSE CATEGORY: **AUDIT COURSE**

COURSE CODE : **EV151G**

COURSE TITLE : **ENVIRONMENTAL SCIENCE**

TEACHING SCHEME: **TH: 02; TU: 00; PR: 00 (CLOCK HRs.)**

TOTAL CREDITS : **02 (1 TH CREDIT = 1 CLOCK HR.)**

TH. TEE : --

PR. TEE : --

PT : --

❖ **RATIONALE:**

The world today is facing the biggest challenge of survival. Degradation of ecosystem, depletion of natural resources, increasing levels of pollution, poses major threat to the survival of mankind. The need of the hour, therefore, is to concentrate on the area of environmental science, which shall provide an insight into various environment related issues.

Environmental science is an interdisciplinary academic field that integrates physical and biological sciences, with the study of the environment. It provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems & gives an insight into solutions of Environmental problems.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Acquire the knowledge of terms related to Environmental Studies.
2. Identify natural resources and resolve problems associated with them.
3. Identify alternate energy resources and use them efficiently during their engineering practices.
4. Develop habits which will reduce various types of pollution.

5. Analyze key issues about environment and create public awareness about those environmental issues.
6. Acquire formal & non formal environmental education.

❖ **COURSE DETAILS:**

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Earth System and Resources	1a. Prepare list of historical events of earthquakes, volcanoes, Tsunami, cyclone & landslides in the world. 1b. Identify problems associated with soil, water. 1c. Differentiate weather and climate. 1d. Analyze the global water problems.	1.1 Earth Science: Concepts of Geologic time scale; earthquakes, volcanoes, Tsunami, cyclone & landslides 1.2 The Atmosphere: Weather and climate; the Coriolis Effect 1.3 Global Water Resources and Use: Present scenario, surface and groundwater issues; global problems; and its conservation. 1.4 Soil : soil erosion and other soil problems; methods of soil conservation	04
2. Concept of Biodiversity	2a. Describe Biodiversity. 2b. Identify Levels of Biodiversity. 2c. Prepare a list of biodiversity hotspots 2d. List the endangered species. 2e. Prepare a report on value of Biodiversity. 2f. Suggest methods / steps for Biodiversity conservation .	2.1 Definition of Biodiversity 2.2 Levels of biodiversity 2.3 Value of biodiversity 2.4 Threats to biodiversity, loss of biodiversity (biodiversity hotspots) 2.5 Conservation of biodiversity (modern methods of biodiversity conservation)	04
3. Energy Resources and Consumption	3a. Match the energy forms projects. 3b. Describe various forms of energy. 3c. Describe advantages and disadvantages of forms of energy. 3d. Select appropriate solutions of Efficient use of energy. 3e. Utilize techniques for energy consumption to reduce impact on environment.	3.1 Energy Consumption history 3.2 Present global energy use, Future energy needs 3.3 Energy forms:(conventional and non conventional) 3.4 Energy Conservation 3.5 Renewable Energy: Solar energy; solar electricity; biomass; wind energy; ocean waves and tidal energy; geothermal	06

4. Pollution	4a. Define pollution and pollutants. 4b. Classify various types of pollutants. 4c. Identify the Pollutants and their sources. 4d. Develop habits to reduce pollution. 4e. State the standard / limiting/ controlling values of various type of pollution.	4.1 Definition of pollution. 4.2 Air pollution: Definition, Classification, sources, effects, Prevention and ambient air quality standards. 4.3 Water Pollution: Definition, Classification, sources effects, Prevention And WHO and BIS water quality standards. 4.4 Soil Pollution/land pollution: Definition, sources, effects prevention 4.5 Noise Pollution: Definition, sources, effects, prevention. 4.6 Biomedical Waste and E-Waste – Origin, Effects and control Measures. 4.7 CPCB and MPCB norms and roles and responsibilities.	08
5. Social issues and Environment	5a. Describe sustainable development. 5b. Evaluate sources of Green house effect, acid rains, Global warming. 5c. Describe the incidences of Nuclear accidents.	5.1 Concept of development, sustainable development 5.2 Watershed management , rain water harvesting 5.3 Global Warming, greenhouse effect; ozone depletion, relevant laws and treaties 5.4 Nuclear Accidents and Holocaust: Basic concepts and their effect on climate, , relevant laws and treaties	05
6. Environmental Education	6a. Differentiate formal and non formal education. 6b. Describe various acts and their provisions. 6c. Develop awareness about environment.	6.1 Formal and non-formal education 6.2 Role of Govt. and Non-Govt. Organization 6.3 Indian constitutional provisions regarding the environment. Brief description of the following acts and their provisions: Environmental Protection Act and Prevention of Water, air and noise Pollution Act. 6.4 Concepts EIA and environmental Ethics	05
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Assignments	Specific Learning Outcomes (Psychomotor Domain)	Units
1	Prepare report on Loss of biodiversity, its conservation and also describe biodiversity hotspots.	Concept Of Biodiversity
2	Prepare report on use of various renewable energy sources.	Energy Resources And Consumption
3	Assignment on article collection from news papers, magazines and internet on local environmental pollution.	Pollution
4	Prepare report on case study of Industrial /Nuclear / any other Disaster in India.	Social Issues And Environment

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Nil

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Nil



❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Class Room Assignments		Assignments	--	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	Theory Answer Scripts	1,2,3,4,5,6
				Total	--	--		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	--	--	--	--
		Journal Writing		Assignments	--	--	--	--
				Total	--	--		
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

Nil

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							PSO	
	1	2	3	4	5	6	7	9	10
1	3	-	-	-	2	-	-	-	-
2	3	-	-	-	2	-	2	-	-
3	3	-	-	-	2	-	2	-	-
4	2	-	-	-	2	-	-	-	-
5	3	-	-	-	2	-	2	-	-
6	2	-	-	-	2	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Environmental studies	Oxford University Press, New Delhi. 2011	0-19-807228-2
2	Environmental Science	Y.K. Singh, New Age International, New Delhi	8122418481, 9788122418484
3.	A Text Book Of Environmental Science	Arvind Kumar, APH Publishing, New Delhi	817648590X, 9788176485906
4	Environmental Engg	A Kamla & D.L.Kanth Rao, Tata Mc Graw-Hill, New Delhi	0-07-451708-2
5	A Textbook of Environmental Studies	Shashi Chawla, Tata Mc Graw-Hill, New Delhi	9781259006388
6	Environmental studies	Erach Bharucha	UGC , New Delhi

❖ **E-REFERENCES:**

1. https://en.wikipedia.org/wiki/Lists_of_nuclear_disasters_and_radioactive_incidents, accessed on 20 January 2021
2. www.legalserviceindia.com/articles/noip.htm accessed on 18 March 2021
3. <https://prezi.com/8mnz--ldkybc/apes-unit-1-earth-systems-resources/> accessed on 23 March 2021
4. <http://www.conserve-energy-future.com/AlternativeEnergySources.php>, 18 March 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.N.V Raut	Head of Civil Engineering, (I)	Government Polytechnic, Nagpur.
2	Dr.S.R.Kukdapwar	Head of Civil Engineering, (II)	Government Polytechnic, Nagpur.
3	Dr.Mrs.R.A.Wankhade	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
4	Mr. A.J.Fulzele	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.
5	Mr.V.B. Dhait	Lecturer in Civil Engineering	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC201G^{\$}
COURSE TITLE	: ELECTRONIC DEVICES AND CIRCUITS^{\$}
TEACHING SCHEME	: TH: 04; TU: 00; PR: 02 (CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

Electronics Engineers must deal with the various types of electronic circuits which generate the required analog/ digital output. These circuits are used as functional blocks in complex systems like analogue and digital applications for signal generation & processing. It intends to teach the operating principle and application of electronic circuits like wave shaping circuits, amplifiers, regulators, oscillators, multivibrators and time base generators. This course will enable the students to learn about the use of transistors in analog circuits like voltage amplifier, power amplifier, multistage amplifier, tuned amplifiers, oscillators, etc.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Select devices and components for particular wave shaping circuits.
2. Troubleshoot regulated power supply.
3. Analyze different multistage amplifier circuits.
4. Analyze different power and tuned amplifier circuit.
5. Use feedback amplifier and oscillator circuit for the given specifications.
6. Build Multivibrators and Time Base Generators circuit to generate required output waveform.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Wave Shaping Circuits	1a. Classify different wave shaping circuits. 1b. Describe the working of given linear wave shaping circuit with neat diagrams. 1c. Select the non-linear wave shaping circuit for given application.	1.1 Necessity of wave shaping, Types of wave shaping circuits: Linear and non-linear wave shaping circuits 1.2 Linear wave shaping circuits RC differentiator circuit: circuit diagram, working, its response to sine, square wave and triangular wave, applications RC Integrator circuit: circuit diagram working, its response to sine and square wave, applications 1.3 Non-linear wave shaping circuits Clipping Circuits: Types of clipping circuits using diode with circuit diagram, operation principal and waveforms: Series positive clipper Shunt positive clipper Series negative clipper Shunt negative clipper Biased series and shunt positive clipper Biased series and shunt negative clipper Combinational clipper Applications of clipper circuits Clamping Circuits: Clamper circuits with circuit diagram, operation principal and waveforms of: Positive clamping circuit Negative clamping circuit Biased clamping circuit Applications of clamping circuit- Working of voltage doubler, voltage tripler circuit	12
2. Regulators and SMPS	2a. Interpret the working of given block of the DC regulated power supply. 2b. Describe the terms related to regulation. 2c. Describe the working	2.1 Necessity of regulated power supply, Block diagram of DC regulated power supply and function of each block 2.2 Definition of Line regulation and Load regulation 2.3 Voltage Regulator Circuits Zener	12

	of given regulator circuit with neat diagram. 2d. Compare series and shunt regulators on the basis of given parameter. 2e. Describe the operating principle of short circuit protection. 2f. Implement voltage regulator using regulator IC. 2g. Interpret the working of given block of the SMPS.	diode shunt regulator with operating principle and limitations; Transistorized series voltage regulators with Circuit details, operating principle, advantages, disadvantages, limitations; 2.4 Transistorized shunt voltage regulators with Circuit details, operating principle, advantages, disadvantages, limitations 2.5 Comparison of transistorized series and shunt voltage regulators. 2.6 Circuits detail and operating principle of short-circuit protection circuit in series voltage regulator 2.7 Types of IC Voltage Regulator: 78XX, 79XX and LM317 2.8 Block diagram & working principle of SMPS. Merits and demerits of SMPS over conventional regulators.	
3. FET Amplifier and Multistage Amplifiers	3a. Describe the working principle of FET amplifier with neat diagram. 3b. Analyze given multistage amplifier. 3c. Compare different multistage amplifiers.	3.1 FET Amplifier: Common source amplifier, working principle and applications ,Multistage Amplifiers 3.2 Need of Multistage Amplifiers, Gain of multistage amplifier, General multistage amplifier BJT based Circuit diagram, operating principle, frequency response, advantages, disadvantages and applications of two stage amplifier: Resistance-capacitance coupled (RC) amplifier Transformer coupled (TC) amplifier Direct coupled (DC) amplifier 3.3 Comparison of RC, TC and DC coupled amplifiers	08
4. Power Amplifier and Tuned Amplifier	4a. Describe given term related to power amplifiers. 4b. Build a circuit of given power amplifier. 4c. Describe working principle of basic tuned circuit. 4d. Describe given term related to tuned amplifiers. 4e. Analyze the working of given tuned	Power amplifiers 4.1 Concepts of collector efficiency, distortion and power dissipation capability. 4.2 Circuit diagram, operating principle, characteristic features, advantages, disadvantages and applications of: Class A amplifier Class B amplifier Class B push pull amplifiers Complementary symmetry class B push pull amplifier Class AB amplifier Class C amplifier	12

	amplifier.	Thermal runaway and heat sinks Tuned Amplifiers 4.3 Necessity of tuned amplifier, Basic tuned circuits, series and Parallel resonance in tuned circuits. 4.4 Resonant frequency, resonance curve, band width and selectivity of parallel resonant circuit 4.5 Circuit diagram, working and frequency response of: Single tuned, Double Tuned , Stagger tuned circuits	
5. Feedback Amplifiers and Oscillators	5a. Describe the effect of feedback type on performance of amplifier. 5b. Compare the performance of given types of negative feedback amplifier. 5c. Draw Transistorized circuits for given negative feedback connections. 5d. Describe Barkhausen's criterion for oscillations. 5e. Classify the oscillators. 5f. Analyze the working of given oscillator.	Feedback amplifiers 5.1 Block diagram, principle, advantages, disadvantages of: Positive feedback in amplifiers, Negative feedback in amplifiers 5.2 Block diagram, principle, advantages, disadvantages and applications of: Voltage Shunt negative feedback Voltage Series negative feedback Current Shunt negative feedback Current Series negative feedback 5.3 Transistorized circuits for different negative feedback connections Oscillators LC tank circuit, Barkhausen criterion. Classification of Oscillators Circuit diagram, working and applications of: Hartley oscillator Colpitts oscillator Crystal oscillator	10
6. Multivibrators and Time Base Generators	6a. Build the relevant multivibrator to obtain specified output waveform. 6b. Describe given method of generating a time base signal. 6c. Analyze the waveforms of given time base generator.	Multivibrators 6.1 Circuit details, operating principle, waveforms and Applications of: Astable multivibrator Monostable multivibrator Bistable multivibrator Time Base Generators 6.2 Necessity and features of time base Signal, errors in sweep generator, different methods of generating a time base signal- exponential sweep circuit. 6.3 Circuit diagram and working of Voltage time base circuit, Miller	10

		integrator, Bootstrap sweep circuit, Current time base circuit.	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Build differentiator/ integrator circuit and connect with CRO and observe. Sketch waveforms for sine wave input.	1.Wave Shaping Circuits	02
2	Build positive and negative clipper circuit and connect with CRO and observe. Draw the input and output waveforms.		02
3	Build positive and negative clamper circuit and connect with CRO and observe. Draw the input and output waveforms.		02
4	Plot line regulation / load regulation characteristics of Transistorized series/ shunt regulator/ 78XX IC Regulator.	2.Regulators and SMPS	02
5	Troubleshoot voltage regulated power supply.		02
6	Test the performance of single stage common source FET amplifier.	3. FET Amplifier and Multistage Amplifiers	02
7	Find the gain of RC coupled amplifiers and show that the gain of multistage amplifiers is the product of gain of individual stages.		02
8	Find bandwidth of two stages RC coupled amplifier by plotting frequency response.		02
9	Build the circuit of class A power Amplifier with resistive load and calculate its efficiency.	4.Power Amplifier and Tuned Amplifier	04
10	Test the performance of single tuned amplifier using transistor.		04
11	Build Colpitts oscillator/Hartley Oscillator circuit and measure time period of output signal for different values of resistors/capacitors.	5.Feedback Amplifiers and Oscillators	02
12	Build the astable/ monostable/ bistable multivibrator circuit and plot its output waveform.	6. Multivibrators and Time Base Generators	02
13	Build Miller integrator /Bootstrap sweep generator and measure sweep time of output signal.		04
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Wave Shaping Circuits	02(02)	06(03)	03(03)	11(08)
2	Regulators and SMPS	02(02)	06(03)	03(06)	11(11)
3	FET Amplifier and Multistage Amplifiers	02(00)	03(03)	03(00)	08(03)
4	Power Amplifier and Tuned Amplifier	02(02)	03(00)	06(03)	11(05)
5	Feedback Amplifiers and Oscillators	02(00)	03(03)	06(03)	11(06)
6	Multivibrators and Time Base Generators	02(00)	03(03)	03(00)	08(03)
	Total	12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	4	R	2										
2	1	U	3	1	U	3	3	U	3	1	U	3	3	U	3				3/5
3	2	U	3	2	U	3	5	U	3	2	U	3	5	U	3				3/5
4	4	U	3	6	U	3	1	A	3	6	U	3	1	A	3				3/5
5	2	A	3	3	A	3	6	A	3	4	A	3	5	A	3				3/5
6	4	A	6	5	A	6	2	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	-	-	-
2	3	-	-	3	-	3	3	-	1
3	3	2	-	3	-	-	-	-	-
4	3	2	-	3	-	-	-	-	-
5	3	-	-	3	-	3	3	-	-
6	3	-	-	3	-	3	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Textbook of Applied Electronics	R. S. Sedha , S. Chand and Co. Ltd., Reprint, 2014	8121927838, 9788121927833
2	Principles Of Electronic Devices and Circuits	A. K. Theraja, B. L. Theraja, R. S. Sedha S. Chand and Co. Ltd., Reprint, 2005	10: 8121921996 13: 9788121921992
3	Principles of Electronics	V. K. Mehta, S. Chand, New Delhi, 2014	8121924502

4	Electronics Devices and Circuits	S. Salivahanan , Tata McGraw Hill Education. Reprint 2012	9781259006418
5	Electronics Devices and Circuits	Allen Mottershed , Tata McGraw Hill, 1984	9788120301245
6	Pulse, Digital And Switching Waveforms	Jacob Millman, H.Taub, Tata McGraw Hill Education, First Reprint 2011	10: 0-07-107272- 113: 978-0-07- 107272-4
7	Electronics Devices and Circuit Theory	Robert L. Boylestad, Louis Nashelsky, Pearson Education, New Delhi, 2014	97801322622264

❖ **E-REFERENCES:**

- <http://www.nptel.ac.in/courses/117101106/10>, assessed on 9th February 2016
- <https://www.electronicsforu.com/resources/electronic-devices-and-circuit-theory>
- https://www.youtube.com/watch?v=3l_9NEh4Nz8 , assessed on 30th August 2016
- https://www.electronics-tutorials.ws/amplifier/amp_1.html
- <https://www.alldatasheet.com/view.jsp?Searchword=Bc147>
- <https://www.futurlec.com/>
- <https://electronicspost.com/discuss-the-essentials-of-a-transistor-oscillator-explain-the-action-of-tuned-collector-oscillator-colpitts-oscillator-and-hartley-oscillator/>
- https://www.electronics-notes.com/articles/analogue_circuits/power-supply-electronics/switch-mode-smmps-basics-primer.php
- <https://www.circuitstoday.com/ic-723-voltage-regulators>

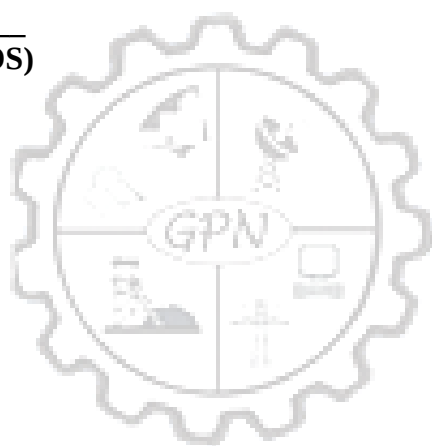
❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Dual Power Supply 0- 30 Volt, 2 A with digital display
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 Mhz
3. Function Generator 0-2 MHz with sine, square, triangular output with variable frequency range 0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
4. Digital Multi-meter 3.5 digit with R ,V, I measurements, diode and BJT testing

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Prof. N. V. Chide	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Dr. M. N. Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip V. Darwhekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Prof. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC202G
COURSE TITLE	: ELECTRONIC INSTRUMENTATION
TEACHING SCHEME	: TH:03; TU: 00;PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

This course is introduced with a view that students will be made aware of various electronic instruments and measuring. It deals with various basic transducers needed for the measurements of various physical parameters, their types and recording systems with interfacing circuits needed in measurements systems. It also deals with various parameter of measurement systems.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify various measuring instrument.
2. Use various type of sensors and transducers.
3. Select the instrument for the measurement of discrete components.
4. Demonstrate the data processing and signal conditioning System.
5. Use CRO for measurement and testing.
6. Operate different recorders and digital instruments.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Introduction to Instrumentation	1a. Describe the role of instrumentation system for given industries. 1b. Determine static and dynamic characteristic of measuring instrument with given data. 1c. Classify the standards used in measurements on given points 1d. Describe applications of instrumentation system in industries.	1.1 Instrumentation System: Block diagram of instrumentation System and function of each block, Role of instrumentation system in industry. 1.2 Static characteristics:- Definition of Accuracy, precision, error. Sensitivity and resolution, repeatability and reproducibility. Linearity and nonlinearity of systems Dynamic characteristics:- Definition of hysteresis, drift, speed of response, lag, fidelity. 1.3 Standards in measurement, International standards, Primary and secondary standards, Need of Calibration 1.4 Applications of instrumentation system.	06
2. Sensors & Transducers	2a. Describe different types of sensor with diagram. 2b. Select the relevant transducer for given application. 2c. Describe working principle of different Temperature, displacement and level measurement methods. 2d. Select the relevant instrument for given flow measurement.	2.1 Sensor: definition and classification of sensor Working principle of Thermal, Electric, optical and magnetic sensor. 2.2 Transducer: definition, selection criteria and classification of transducer 2.3 Working of Resistive, capacitive transducer, Primary and secondary transducer, LVDT, RVDT, Piezoelectric transducer with block diagram Temperature Measurement: Working of Thermocouple, Resistive Temperature Device (RTD) Thermistor, Pyrometer. Level Measurement: working principle and construction of Float type, Ultra sonic type, Radiation type and capacitive type with block diagram. 2.4 Flow Measurement: working principle and construction Electromagnetic flowmeter, Hot wire Anemometer with block diagram	10

3. Discrete Component Measurement	3a. Compare AC and DC bridge with given point. 3b. Select the relevant Bridge for given measurement. 3c. Describe working of high frequency measurements methods.	3.1 General equation for bridge balance , Comparison of AC and DC bridge 3.2 Resistance measurement using Wheatstone bridge, Kelvin bridge and Capacitance measurement using Schering Bridge, derivation for bridge balance, Low frequency inductance measurement using Maxwell Bridge, derivation for bridge balance. 3.3 Principle of Q meter, High frequency measurement using Q meter and working of LCR meter with diagram.	08
4. Data Processing & Signal Conditioning	4a. Necessity of given data processing system. 4b. Select data processing systems for relevant application. 4c. Identify the need of signal conditioning for given measurement. 4d. Comparison of AC and DC signal conditioning on given point.	4.1 Necessity of Data Acquisition System (DAS) and Data logger. 4.2 Block diagram and working of Data Logger and PC based monitoring system. 4.3 Introduction to Signal conditioning . Necessity of signal conditioning 4.4 Working and Block diagram of AC signal conditioning and DC signal conditioning	08
5. Oscilloscope	5a. Describe working of given deflection system. 5b. Identify different block of given CRO/DSO 5c. Select DSO for given application.	5.1 Construction and working of Cathode ray tube(CRT) and CRO and Vertical deflection system and Horizontal deflection system. 5.2 Front panel controls of CRO,Block diagram and working of Dual beam and dual trace CRO, applications of CRO. 5.3 Block diagram and working of Digital Storage oscilloscope and Applications of DSO	10
6. Recorders and Digital Instruments	6a. Select records for given application. 6b. Identify the types voltmeter from given data. 6c. Describe digital instruments used instrumentation. 6d. Select the virtual instrument for given applications.	6.1 Working and block diagram of Strip chart recorder, X-Y Recorder , Logic analyzer and spectrum analyzer. 6.2 Digital measuring instrument: Digital Voltmeter:Working and block diagram of Ramp type Digital Voltmeter, Dual slope Digital Voltmeter and Integrating type Digital Voltmeter. 6.3 Working and block diagram of Digital Frequency Counter and digital Multimeter 6.4 Concept of Virtual instrumentation.	06

		General block diagram and architecture of a virtual instrument Advantages & disadvantages of virtual instrumentation Overview of LAB view	
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify various instruments used in Electronics Laboratory and draw front panel of Digital Voltmeter, LCR meter and CRO.	1.Introduction to Instrumentation	04
2	Measure displacement using LVDT.	2.Sensors & Transducers	02
3	Measure the temperature by using Thermistor.		02
4	Measure angular displacement using RVDT		02
5	Measure unknown resistance using Wheatstone bridge	3.Discrete Component Measurement	02
6	Measure the values of inductance, capacitance and resistance using LCR meter.		02
7	Collect the information about Data Logger for different applications.	4.Data Processing & Signal conditioning	04
8	Operate front panel controls of CRO.	5. Oscilloscope	02
9	Operate front panel controls of digital storage oscilloscope.		02
10	Test the different component using CRO.		04
11	Measure frequency by Lissajous pattern method using CRO.		02
12	Use the spectrum analyzer to measure frequency band of given input.	6. Recorders and Digital Instruments	04
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction to Instrumentation	02(02)	06(03)	00(00)	08(05)
2	Sensors & Transducers	02(02)	03(03)	06(03)	11(08)
3	Discrete Component Measurement	02(02)	03(00)	03(03)	08(05)
4	Data Processing & Signal conditioning	02(00)	03(06)	06(00)	11(06)
5	Oscilloscope	02(00)	06(00)	03(06)	11(06)
6	Recorders And Digital Instruments	02(00)	03(03)	06(03)	11(06)
	Total	12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

T-Unit/Topic Number L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	1	U	3	2	U	2	4	U	3	1	U	3	2	U	3				3/5
3	1	U	3	2	A	3	3	U	3	2	A	3	3	A	3				3/5
4	2	A	3	3	A	3	4	U	3	5	U	3	6	A	3				3/5
5	6	U	3	5	A	3	4	A	3	5	U	3	6	U	3				3/5
6	5	A	6	6	A	6	4	U	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	3		
2	3	-	-	3	-	-		3	3
3	3	-	-	3	-	-	3	3	3
4	3	-	-	-	-	-		3	3
5	3	-	-	3	-	-	3	3	3
6	3	-	-	3	-	-	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	A Course in Electrical and Electronic Measurements & Instrumentation	A.K.Sawhney, Dhanpat Rai Publications, 2005	8177000160
2	Electronics Instrumentation	H.K. Kalsi ,Publication- Tata McGraw-Hill,2004	0070583706
3	Modern Electronic Instrumentation & Measurement Techniques.	A. D. Helfrick W. D. Cooper, PHI Learning Pvt. Ltd.,2009	9780135932940
4	Transducer and Display Systems :	B.S.Sonde. Tata McGrawHill,1992	9780070966130

❖ **E-REFERENCES:**

- <https://www.electronics-tutorials.ws/io/linear-variable-differential-transformer.html>, accessed on 16th January 2022
- <https://www.elprocus.com/different-types-bridge-circuits-and-circuit-diagrams/>, accessed on 16th January 2022
- https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_data_acquisition_systems.htm, accessed on 18th January 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Digital Multimeter.
2. Regulated Power Supply 0- 30 Volt, 2 A with digital display.
3. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based.
4. Function Generator.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Prof. P. H. Gedam	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Shri. Sandip Darwekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
6	Prof. Kapil Pochpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMM. ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC203G
COURSE TITLE	: PRINCIPLES OF DIGITAL ELECTRONICS
TEACHING SCHEME	: TH:03; TU: 00;PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

Digital Electronics plays important role in advancements of microelectronics design, manufacturing, computer technology and information systems that have caused the rapid increase in the use of digital circuits. Hence in every application digital technique is the backbone. Digital electronics requires the background of discrete signaling and logical functions, semiconductor switch theory. Hence this subject is introduced for students to sharpen their skills of digital implementation by learning the concept of number systems, logic gates, combinational and sequential logic circuits, counter and shift register.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use number system and codes for interpreting working of digital system.
2. Use Boolean expressions and logic gates to realize logic circuits.
3. Build simple combinational circuits.
4. Build simple sequential circuits using flip flops.
5. Design the counters and registers.
6. Use different Data Converters.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Number System, Codes and Logic Families	1a. Compare analog and digital systems on given points. 1b. Convert the given number into specified number system. 1c. Perform simple Binary Arithmetic operations on given binary data. 1d. Represent the given number in different signed representation. 1e. Perform the binary subtraction using compliment arithmetic. 1f. Convert the given coded number into other specified code. 1g. Perform the BCD addition on given data. 1h. Perform the BCD subtraction using compliment arithmetic on given data. 1i. Compare logic families on the basis of characteristics.	1.1 Introduction to digital signal, Advantages of Digital System over analog systems. 1.2 Number Systems: Different types of number systems-Decimal, Binary, Octal, Hexadecimal. 1.3 Conversion of number from one number system to another system. 1.4 Signed Binary Numbers: Signed magnitude representation, One's compliment representation, Two's Compliment Representation. 1.5 Binary arithmetic: Addition, Subtraction, Multiplication, Division. Rules and numerical on it. 1.6 Compliment Arithmetic: Subtraction using 1's Complement, Subtraction using 2's Complement. Rules and numerical on it. 1.7 Codes: BCD, Gray Code, Excess-3, ASCII code. Conversion from one code to other i.e Binary to BCD, Gray, Excess-3 and ASCII and vice versa. 1.8 BCD arithmetic: 9's and 10's complement. BCD addition, BCD subtraction using 9's and 10's Complement. Rules and numerical on it. 1.9 Logic Families: Characteristics of logic families & Comparison between logic TTL and CMOS families.	08
2. Logic Gates	2a. Analyze the output of given logic gates for different inputs using respective truth table and logic symbol. 2b. Develop logic circuit for Boolean equation up to three variables by using Boolean algebra. 2c. Implement the given	2.1 Logic gates: – Basic gates – AND, OR, NOT gate. – Derived Gates – NAND, NOR, EX-OR, EX-NOR gate. 2.2 Boolean Algebra: – Fundamentals of Boolean laws, – Duality Theorem, De Morgan's theorems. – Statement and Proof. – Numerical based on simplification of logic expression.	06

	logic gate using Universal gates.	2.3 Universal Gates: – NAND and NOR as Universal gate. – Implementation of basic logic gates using NAND and NOR gate.	
3. Combination al Logic Circuits	3a. Develop logic circuits in standard SOP/POS form for given logical expression. 3b. Minimize the given logic expression using K-Map. 3c. Design arithmetic circuits and code converter using K-map. 3d. Describe the working of Multiplexer and demultiplexer. 3e. Implement higher order Multiplexer and demultiplexer tree using lower order Multiplexer and demultiplexer. 3f. Implement given logic expression using suitable Multiplexer and demultiplexer. 3g. Describe the working of Encoder and Decoder Circuits. 3h. Realize the circuit of given Priority Encoder.	3.1 Standard representation of Logic functions: Sum of Product (SOP), Product of sum (POS), Max term & Min term, Conversion between SOP and POS forms. 3.2 Karnaugh Map representation of Logic Functions: Using Truth table, Canonical SOP and POS. Simplification of logic functions using K-Map: of SOP, POS and Don't Care condition 3.3 Design Examples using K-map: – Half and full Adder – Half and Full Subtractor. – BCD-to-7-Segment Decoder – Binary to Gray Code Converter (up to 4-bit) – Gray to Binary Code Converter (up to 4-bit) 3.4 Multiplexers(MUX) and Demultiplexer (DEMUX) : Block diagram, truth table, logic expression and logic diagram of 2:1, 4:1, 8:1 MUX and 1:2,1:4,1:8 DEMUX, 3.5 MUX tree and Demux tree. Implementation of logic functions: Using MUX and DeMUX. 3.6 Encoder and Decoder: Block diagram, truth table, logic expression and logic diagram of 8:3 Encoder, Demux as a decoder. 3.7 Priority Encoder 8:3, Decimal to BCD Encoder	12
4. Flip-Flops as Sequential Circuits	4a. Compare Combinational & Sequential circuits on given parameters. 4b. Describe working of RS latch – using given universal gates. 4c. Compare different Triggering Methods on given points. 4d. Distinguish given Flip-Flops on basis of	4.1 Comparison between Combinational & Sequential circuits 4.2 One bit memory cell - RS latch – using NAND & NOR. Difference between Latch and flip-flop. 4.3 Triggering Methods: Edge and Level trigger. 4.4 Flip Flops - S R Flip flop,Clocked SR flip flop with preset and clear, Drawbacks of SR Flip flop. Clocked JK Flip flop with preset & clear, Race around condition in JK flipflop,	08

	given parameters. 4e. Realize given flip flop from one type of flip flop to another type of flip flop using excitation table	Master slave JK flip flop. D-Type flip-flop. T-Type flip flop. 4.5 Excitation table of flip flops. Conversion from one type of Flip-Flop to another type: – S-R to D-type – J-K to D-Type – J-K to T-Type.	
5. Registers and Counters	5a. Distinguish given shift registers based on given points. 5b. Construct ring and twisted ring counter using the given flip-flop. 5c. Distinguish between asynchronous and synchronous counters on the basis of given points. 5d. Design asynchronous Counter using suitable flip flop. 5e. Design synchronous Counter using suitable flip flop. 5f. Design the modulo-n counter using IC 7490.	5.1 Introduction to Registers: Shift Registers: Logic circuit and waveforms of: 4-bit Shift registers SISO, SIPO, PISO, and PIPO, 4-Bit Universal Shift register. Applications of Shift Register: 5.2 Ring counter, twisted ring counter. 5.3 Counters: Modulus of counter, types of counter as Asynchronous and Synchronous counter and comparison. 5.4 Asynchronous counter: Ripple counter, 4 bit up/down Counter. Design of MOD-n asynchronous counter. 5.5 Synchronous counter: Design of 3 bit counter. State transition table. Design of MOD-n synchronous counter. 5.6 Block schematic and waveform of IC 7490 as MOD-n Counter.	08
6. Data Convertors	6a. Compare given types of DAC and ADC on the basis of given parameters. 6b. Describe operation of given DAC 6c. Describe operation of given ADC. 6d. Use of IC 0808, 0809 in given practical applications.	6.1 Introduction and Necessity of Data Convertors like ADC and DAC. DAC Types and their comparison, ADC Types and their comparison 6.2 Working of Weighted resistor method and R-2R Method, Mathematical derivation up to 3 variable) 6.3 Block Diagram and working of following ADCs: Single slope ADC, Dual slope ADC, SAR ADC 6.4 IC0808 and IC0809	06
		Total Hrs	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Collect the datasheet of NAND/NOR gate IC for TTL and CMOS.	1.Number System, Codes and Logic Families	02
2	Apply the input and verify the truth table of different logic gates using suitable IC.	2.Logic Gates	02
3	Assemble various basic gates using universal gates and relate it with specific truth table.		02
4	Apply the input and verify the De Morgan's Theorem using suitable logic gates.		02
5	Assemble the logic circuit for half adder and full adder using logic gates and verify its truth table.	3.Combinational Logic Circuits	02
6	Identify different pins of 8:1 multiplexer IC, apply input, measure output and relate it with the truth table.		02
7	Identify different pins of 1: 8 de-multiplexer IC, apply input, measure output and relate it with the truth table.		02
8	Identify different pins of J K flip flop IC, apply input, measure output and relate it with the truth table.	4.Flip-Flops as Sequential Circuits	04
9	Identify different pins of D/T flip flop IC, apply input, measure output and relate it with the truth table.		04
10	Design 4 bit synchronous counter using Flip Flop, show its output on LED and relate it with the truth table.	5.Registers and Counters	02
11	Assemble decade counter using IC 7490, show its output on LED and relate it with the truth table.		02
12	Assemble 4 bit SISO/PIPO register using flip flop, show its output on LED and relate it with the truth table.		02
13	Build R-2R resistive network on breadboard to convert given digital data into analog.	6. Data Convertors	04
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Number System, Codes and Logic Families	02(02)	03(00)	00(00)	05(02)
2	Logic Gates	02(02)	03(03)	03(00)	08(05)
3	Combinational Logic Circuits	02(00)	06(03)	06(03)	14(06)
4	Flip-Flops as Sequential Circuits	02(00)	06(06)	06(03)	14(09)
5	Registers and Counters	02(02)	03(03)	06(03)	11(08)
6	Data Convertors	02(00)	03(03)	03(03)	08(06)
	Total	12(06)	24(18)	24(12)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	5	R	2										
2	1	U	3	2	U	3	3	U	3	4	A	3	6	A	3				3/5
3	2	A	3	5	U	3	6	U	3	3	U	3	2	U	3				3/5
4	3	A	3	4	U	3	6	A	3	5	U	3	6	U	3				3/5
5	3	U	3	4	U	3	3	A	3	5	A	3	3	A	3				3/5
6	4	A	6	5	A	6	4	U	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcome	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	3	-	-
2	3	-	-	-	-	-	-	3	3
3	3	-	2	3	-	2	3	3	3
4	3	-	-	-	-	-	-	3	3
5	3	-	2	3	-	2	3	3	3
6	3	-	-	3	-	-	-	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Digital Integrated Electronics	Herbert Taub (Author), Donald L. Schilling, McGraw-Hill Inc, 1977	10: 0070857881 13: 9780070857889
2	Digital Principles and Application	Malvino, Albert Paul; Leach, Donald P., Mcgraw-Hill, 1986	10: 0070398836 13: 9780070398832
3	Modern Digital Electronics	R.P.Jain, McGraw Hill Education (India) Private Limited, 2009	10: 0070669112 13: 9780070669116
4	CMOS/TTL A user's guide with projects	Joseph J. Carr, TAB Books, 1st Edition, 1984	10: 0830616500 13: 9780830616503

❖ **E-REFERENCES:**

- www.electrical4u.com/digital-electronics , accessed on 03 March 2022
- <http://nptel.ac.in/courses/108108076/1> , accessed on 03 March 2022
- <http://www.electrical4u.com> , accessed on 03 March 2022
- <https://www.youtube.com/watch?v=A9KSGAnjo2U>, accessed on 03 March 2022

❖ **LIST OF MAJOR EQUIPMENT/INSTRUMENTS WITH SPECIFICATION:**

1. Digital Multi-Meter.
2. Logic Gates ICs (7400,7402,7404,7408,7432,7486)
3. Multiplexer and De multiplexer IC (74150,74151,74138,74139)
4. Flip Flops ICs (7472,7474,74H71,74L71)
5. Breadboard and LEDs.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr.V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Prof. S. S. Pampattiwar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. S.V. Darwhekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
6	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME ENGINEERING	: DIPLOMA IN ELECTRONICS & TELECOMM ENGG
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC204G
COURSE TITLE	: BASICS OF COMMUNICATION
TEACHING SCHEME	: TH: 03; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

Conveying an information by some means such as gestures, sounds, actions, etc., can be termed as signaling. Hence, a signal can be a source of energy which transmits some information. This signal helps to establish a communication between the sender and the receiver. The objective of this course is to establish foundation for understanding the relationship among various technical factors useful in designing & operating communication system. It describes the basic facts, concepts & principles to understand basic elementary knowledge related to communication area in Electronics Engineering.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Set up a given type(s) of communication link between transmitter & receiver.
2. Use amplitude modulation technique for a given application.
3. Use angle modulation technique for a given application.
4. Analyze the various characteristics and performance analysis of AM & FM receivers.
5. Measure the different parameters of transmission line.
6. Choose different type of antennas for relevant application.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Fundamentals of Communication	1a. Describe given communication system with the block diagram. 1b. Analyze the Electromagnetic spectrum 1c. Identify the applications of communication system in various areas. 1d. Describe modulation process & the need of modulation in communication system. 1e. Compare different types of Noises on a given points.	1.1 Introduction to basic electronic communication system. Block schematic and elements of communication systems. Types of electronics communication: Simplex, half duplex & full duplex. 1.2 Electromagnetic spectrum - different bands & their corresponding frequencies and applications. 1.3 Applications of communication system 1.4 Definition of modulation, Necessity of Modulation, Types of modulation: AM- Amplitude modulation, FM- Frequency modulation, PM- Phase modulation. 1.5 Definition of Noise, Origin of Noise, Classification of Noise: internal, external, atmospheric, thermal, Shot transit time, partition, flicker and white noise. Definition of signal to noise ratio (S/N), Noise Figure	06
2. Amplitude Modulation	2a. Calculate the modulation index of generated AM wave 2b. Represent AM wave in time & frequency domain 2c. Classify the types of AM Generation 2d. Describe principle of working of given amplitude modulation system.	2.1 Definition of Modulation index (M.I.), Effect of M.I. on modulated signal, sidebands, Power relations in AM wave (derivation & simple numerical), Definition of bandwidth & numerical, AM theory-mathematical expression 2.2 Representation of AM signal in time & frequency domain. 2.3 AM Generation: Low level and High Level Modulation. Collector modulated BJT amplifier, Balanced modulator (using diode) 2.4 Types of Amplitude modulation: • DSBSC (Double Sideband Suppress Carrier) • SSBSC (Single Sideband Suppress Carrier) • VSB: Generation method	09

3. Frequency Modulation	3a. Describe the process of Frequency modulation & related terms. 3b. Calculate modulation index & bandwidth of generated FM wave. 3c. Describe principle of working of a given frequency modulation system.	3.1 Definition of Frequency modulation & Phase modulation. FM theory – mathematical representation, FM Characteristics 3.2 Definition of Modulation Index (M.I.), Frequency spectrum & bandwidth of FM, Numerical on M.I., Comparison of AM, FM and PM, Pre-emphasis and de-emphasis circuits. 3.3 FM transmitter: Basic block diagram & description • FM Generators; circuit diagrams & description • FET reactance modulator; circuit diagram & description • Varactor diode modulator; circuit diagram & description • Narrow band & wide band FM • Armstrong FM system	09
4. AM & FM Receiver	4a. Classify the different types of radio receiver. 4b. Describe working principle of given radio receiver with block schematic. 4c. Describe the process of demodulation & classify its types. 4d. Demonstrate the working principle of given AM Detector. 4e. Demonstrate the working principle of given FM Demodulator.	4.1 Definition of radio receiver. Characteristic and types of radio receiver. 4.2 Tuned radio frequency (TRF) receiver & Superheterodyne receiver: block diagram & principle of working, Electronic tuning, Image frequency & its rejection. Double spotting frequency. 4.3 Definition of Demodulation, Amplitude demodulation & Frequency demodulation 4.4 AM detectors: Diode detector & BJT detector; circuit diagram & description 4.5 FM demodulators: Balanced slope demodulator, phase discriminator & Ratio detector	09
5. Transmission Lines	5a. Classify different types of transmission line. 5b. Describe a given transmission line with construction, advantages & disadvantages. 5c. Measure the different parameters of transmission line 5d. Describe a given components of transmission line with construction.	5.1 Definition of transmission line, types of transmission lines 5.2 Equivalent circuit of a parallel wire line, their advantages and disadvantages, Coaxial cables – construction, advantages and disadvantages. 5.3 Characteristic impedance, Losses in transmission lines, Standing waves, Standing wave ratio and Reactance properties of Transmission line. 5.4 Transmission line components- double stub and Directional coupler. Electromagnetic radiation	06

6. Antenna & Wave Propagation	6a. Classify the types of antennas. 6b. Describe a given parameter(s) of Antenna 6c. Choose different type of directional high frequency antennas for relevant application 6d. Select different type of UHF & Microwave Antennas for relevant applications. 6e. Classify different types of propagation	6.1 Definition of antenna, radiation mechanism, types of antennas; resonant & non-resonant antenna. 6.2 Definitions of: Directive gain, directivity, Power gain, Antenna resistance, Antenna efficiency, Band width, Beam width, Polarization, Effective radiated power. 6.3 Effect of ground on antenna, Directional high frequency antenna: Dipole arrays, Broad side array, End fire array, Folded dipole, Yagi-uda antenna; construction & radiation pattern. 6.4 UHF and Microwave antenna: Parabolic Antenna, Turnstile antenna, Rhombic, Horn, loop antenna; construction & radiation pattern. 6.5 Wave propagation: Electromagnetic radiation, Propagation of waves, Ground waves, Sky waves, Space waves, Tropospheric propagation, Critical frequency, Skip distance and MUF	09
Total Hrs.			48

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Set up a simplex and half duplex communication link between transmitter & receiver..	Fundamentals of Communication	2
2	Calculate the modulation index by generating amplitude modulated (AM) waveform for various modulating voltages.	Amplitude Modulation	4
3	Generate Double Sideband Suppressed Carrier (DSBSC) waveform using balanced modulator and draw the related waveforms.		4
4	Calculate the modulation index and bandwidth by generating frequency modulated (FM) waveform for various values of amplitude & frequency of modulating signals.	Frequency Modulation	4
5	Demodulate the amplitude modulated (AM) waveform and to recover the modulating signal	AM & FM Detectors	2
6	Demodulate the frequency modulated (FM) waveform to recover the modulating signal by using IC565 PLL		2
7	Test the voltages at various stages of super heterodyne AM receiver and draw the related waveforms.		2
8	Measure the attenuation loss along the transmission line - Coaxial cable	Transmission Lines	2
9	Measure the standing wave ratio (SWR) along the transmission line – Coaxial cable.		2
10	Measure the gain and beam width of Yagi- Uda Antenna.	Antenna & wave propagation	2
11	Determine the radiation pattern of the given Yagi-Uda antenna		2
12	Determine the radiation pattern of the given dipole antenna.		2
13	Analyze various types of wave propagations and prepare the chart		2
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Fundamentals of Communication	02(00)	03(03)	03(00)	08(03)
02	Amplitude Modulation	02(02)	06(03)	03(03)	11(08)
03	Frequency Modulation	02(02)	03(03)	06(03)	11(08)
04	AM & FM Detectors	02(00)	03(03)	06(03)	11(06)
05	Transmission Lines	02(02)	03(03)	03(00)	08(05)
06	Antenna & Wave Propagation	02(00)	06(00)	03(06)	11(06)
	Total	12(06)	24(15)	24 (15)	60 (36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

T= Unit/Topic Number

L= Level of Question

M= Marks

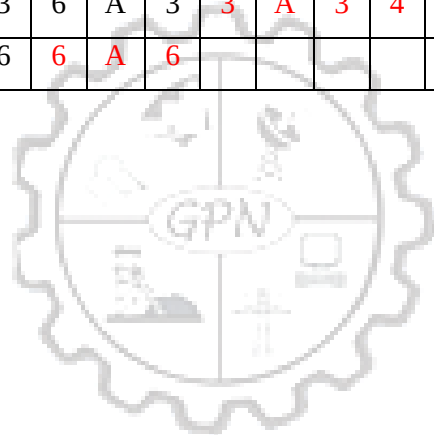
R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
01	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	3	R	2	5	R	2										
02	1	U	3	2	U	3	3	U	3	1	U	3	2	U	3				3/5
03	4	U	3	5	U	3	6	U	3	3	U	3	4	U	3				3/5
04	2	U	3	6	U	3	1	A	3	5	U	3	2	A	3				3/5
05	2	A	3	5	A	3	6	A	3	3	A	3	4	A	3				3/5
06	3	A	6	4	A	6	6	A	6										2/3



❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	3	-	-
2	3	-	3	3	3	-	3	3	3
3	3	-	3	3	3	-	3	3	3
4	3	-	3	3	3	-	3	3	3
5	3	-	-	3	3	-	3	3	3
6	3	-	-	-	-	-	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1.	Electronic Communication System	George Kennedy McGraw-Hill, 4th Edition , 1992	10: 0071126724 13: 978-0071126724
2.	Communication Electronics-Principles and applications	Louis E. Frenzel: McGraw-Hill, 1999	10: 0070483981 13: 9780070483989
3.	Electronic Communication	Dennis Roddy, Pearson Education India, 1977	8177585584, 9788177585582
4.	Electronic communication system: Fundamentals Through Advanced	Tomasi W.	Pearson Education India, New Delhi-2001, 4 th Edition, ISBN: 80130221254
5.	Antenna Theory: Analysis and Design	Constantine A. Balanis	Wiley-Student, New Delhi, India 2015-16, ISBN: 788126524228

6.	Principles of Communication Engineering	Anokh Singh	S.Chand & Co ltd, 3rd edition New Delhi-1999 ISBN -10:8121900530
7.	Telecommunication	W. FRASER	Tata McGraw-Hill, India ISBN-10:0130278203

❖ **E-REFERENCES:**

1. http://www.pa2old.nl/files/am_fundamentals.pdf, accessed on 25th January 2022
2. <http://www.radio-electronics.com/info/rf-technology-design/fm-reception/fm-demodulation-detection-overview.php>, accessed on 25th January 2022.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Ammeter MI 0-5-10 A
2. Voltmeter MI 0-150-300 V
3. CRO
4. Digital Multi-meter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R.V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Dr. D. N. Bhange	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Mrs. U. M. Ramteke	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5.	Mr. Sandip V. Darwhekar	Director	Beta Computronics Pvt. Ltd. Nagpur
6.	Mrs. Gazala Ali	HOD, Electronics	Anjuman Polytechnic, Nagpur.
7.	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.

COURSE CATEGORY : PROGRAMME CORE COURSE

COURSE CODE : EC205G

COURSE TITLE : CIRCUIT ANALYSIS AND SIMULATION

TEACHING SCHEME : TH: 04; TU: 00; PR: 02(CLOCK Hrs.)

TOTAL CREDITS : 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH.TEE EXAM : 03 HRs

PR. TEE EXAM : 02 HRs

PT. EXAM : 01 HR

❖ RATIONALE:

This course lays emphasis on basic laws, theorems and techniques for network analysis which helps students to find different electrical parameters for a given network. It forms the foundation to understand various application level subjects such as electrical machines, power systems, measurements and control. The study of this course will make the students more able to use and implement the basic rules, laws and theorems for design, analysis and simulation of any networks.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Apply network rules and laws for simplification of networks.
2. Analyse the DC networks using various analysis techniques.
3. Use network theorems on resistive DC networks
4. Measure electrical parameters of the resonant circuits using electronic and electrical tools .
5. Analyse two port networks and filter circuits.
6. Perform simulation using software for design of networks.

❖ COURSE DETAILS:

A. THEORY :

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Network Basic Rules and Laws	1a. Describe the given terms of networks. 1b. Compare network elements on given points. 1c. Apply principle of duality on given network 1d. Apply voltage and current division method for finding given parameters 1e. Use KVL or KCL in finding unknown value of current or voltage in a given network	1.1 Introduction to networks: Branch, node and mesh. 1.2 Definition, Classification and comparison of network elements: Active and Passive Unilateral and Bilateral Linear and Non Linear Lumped and Distributed 1.3 Principle of duality, dual pairs practice problems on obtaining dual of given network. 1.4 Voltage division and Current division rule, formulae and practice examples for DC resistive networks. 1.5 Kirchhoff's voltage law (KVL) and Kirchhoff's current law (KCL) statement, practice problems to find unknown value of current and voltages for a given dc resistive network.	10
2. Circuit Analysis Techniques	2a. Apply source transformation method to simplify a given network. 2b. Obtain equivalent star and delta connected circuit using network transformation techniques. 2c. Describe the mesh and nodal analysis method to solve a given network. 2d. Apply the concept of super mesh and super node analysis to find given parameters.	2.1 Source Transformation techniques, conversion of independent sources from voltage source to current source and vice versa, practice examples on conversion. 2.2 Network Transformation techniques: Delta to Star Transformation and vice versa, formula, practice examples. 2.3 Mesh Analysis and Nodal Analysis, procedure for analysis, numerical up to three simultaneous equations 2.4 Concept of Super Mesh and Super Node, procedure, numerical up to three simultaneous equations.	12
3. Network Theorems	3a. Solve a given network problems using superposition theorem. 3b. Apply Thevenin's theorem on given network to find given circuit parameters 3c. Use Norton's theorem to	3.1 Superposition theorem: Statement, solution procedure, and practice examples. 3.2 Thevenin's theorem: Statement, solution procedure and practice examples. 3.3 Norton's theorem: Statement,	12

	solve given circuit problems 3d. Solve DC resistive network using reciprocity theorem. 3e. Determine the given network quantities using maximum power transfer theorem.	solution procedure, and practice examples. 3.4 Reciprocity Theorem: Statement, solution procedure and practice examples. 3.5 Maximum power transfer theorem: Statement, solution steps and practice examples.	
4. Resonant Circuits	4a. Classify the resonance phenomenon used in ac circuits. 4b. Use series resonance in series RLC circuit to find given parameters 4c. Analyse the effect of various parameters on series resonant circuit. 4d. Analyse parallel resonance to obtain given parallel resonant circuit parameters 4e. Relate the effect of parallel resonant circuit parameters.	4.1 Introduction of resonance phenomenon in ac circuits and its types. 4.2 Series resonance, circuit diagram, conditions, resonant frequency, bandwidth and quality factor of series RLC circuit. 4.3 Relationship between impedance, voltage and current with frequency for series resonant circuit. 4.4 Parallel resonance, circuit diagram, conditions, resonant frequency, bandwidth and quality factor of parallel RLC circuit, resonant frequency for a tank circuit. 4.5 Variation of impedance, voltage and current with frequency for parallel resonant circuit.	10
5. Two Port Networks and Filter Circuits	5a. Describe the given terms of two port networks. 5b. Analyse the two port network to find various parameters of the given network. 5c. Design the filter circuits for given criteria	5.1 Introduction to two port network: terminology of two port networks 5.2 Two port networks Parameters: Open circuit impedance (Z) parameters, Short circuit admittance(Y) parameters, transmission (ABCD) parameters, Hybrid (h) parameters, h-parameters of transistor. Derivation and numericals for finding Z, Y, ABCD and h parameters. 5.3 Frequency selective filter circuits: Definition, types of filters, frequency response, and Constant-K low pass filters, Constant-K high pass filters with T and π sections. Design of constant-K low pass filters and constant-K high pass filters.	10

6. Network Simulation With PSPICE	6a. Describe the given simulation rules and steps	6.1 Introduction to PSPICE, Simulation rules, steps	10
	6b. Identify the PSPICE software commands for circuit analysis.	6.2 Basic commands: general forms, syntax rules of commands such as .OP, .END, .PRINT, .DC, .PROBE, .AC, .TRAN.	
	6c. Develop and simulate the given circuit for various analysis.	6.3 Simulation of circuits: types of analysis, DC analysis, Transient (time domain) analysis, AC analysis, Frequency response of RLC circuit	
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs
1	Analyze the given series resistive circuit to measure circuit parameters using Kirchhoff's voltage law.	1. Network rules and laws	02
2	Assemble parallel resistive circuit on breadboard and analyze the results using Kirchhoff's current law.		02
3	Apply the mesh analysis technique on resistive circuit to measure mesh currents and compare with theoretical values	2. Circuit analysis techniques	02
4	Use nodal analysis for given resistive circuit to measure voltages at each node and compare with theoretical values		02
5	Assemble resistive network on bread board with two or more energy sources, measure current at any branch and compare it with theoretical results using Superposition theorem.	3. Network theorems	02
6	Assemble resistive network on bread board, measure voltage at various nodes using Thevenin's theorem, compare results with theoretical values		02
7	Assemble resistive network on bread board, measure current at any branch and compare it with theoretical results using Norton's theorem.		02
8	Use reciprocity theorem for given resistive network to measure the parameters.		02
9	Measure the resonant frequency of series RLC circuit.	4. Resonant circuits	02
10	Plot the frequency response of Low pass filter to find cutoff frequencies	5. Two port networks and filter circuits	02

11	Perform various operations by using the basic commands of PSPICE	6. Network simulation with PSPICE	04
12	Perform DC analysis to measure mesh currents, branch currents, and node voltages for a given resistive network using PSPICE.		02
13	Perform the transient/time domain analysis on series RLC circuit using PSPICE to plot the waveforms		02
14	Perform AC analysis to obtain frequency response of high pass filter using PSPICE.		04
Total Hours			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Network basic rules and laws	02(00)	03(03)	03(03)	08(06)
2	Circuit analysis techniques	02(02)	06(03)	06(00)	14(05)
3	Network theorems	02(00)	06(06)	06(00)	14(06)
4	Resonant circuits	02(02)	00(00)	03(03)	05(05)
5	Two port networks and filter circuits	02(02)	03(00)	06(06)	11(08)
6	Network simulation with PSPICE	02(00)	03(03)	03(03)	08(06)
	Total	12(06)	21(15)	27(15)	60(36)

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	4	R	2	5	R	2										
2	2	U	3	3	U	3	1	U	3	1	U	3	2	R	3				3/5
3	2	U	3	5	A	3	1	R	3	1	U	3	3	U	3				3/5
4	6	U	3	5	A	3	5	U	3	6	U	3	3	U	3				3/5
5	3	U	3	4	A	3	6	A	3	4	U	3	6	U	3				3/5
6	3	A	6	2	A	6	5	A	6										2/3

T -Unit/Topic Number L- Level of Question M- Marks

R-Remember U-Understand A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment t Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ SCHEME OF PRACTICAL EVALUATION:

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment writing procedure etc.	10
2	Performance on breadboard	20
3	Observations, calculations, result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	3	-	-	-	-	-	1	1
2	3	3	3	-	-	-	-	-	1
3	3	3	3	-	-	-	-	-	1
4	3	3	-	-	-	-	-	-	1
5	3	3	-	2	-	-	-	-	-
6	3	3	3	3	-	-	3	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

Sr. No.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Circuits and Networks: Analysis and Synthesis	A. Sudhakar, Shyammohan S. Palli, Tata McGraw-Hill, Fifth Edition, 2006	13:978-93-392-1960-4 10:93-392-1960-0
2	Fundamentals of Electrical Networks	B. R. Gupta & Vandana Singhal, S Chand & company ltd, Fifth Edition, 2005	13:9788121923187 10:8121923182
3	Theory and Problems of Circuit Analysis	T. S. K. V. Iyer, Tata McGraw Hill, First Edition, 1995	0074621653 9780074621653
4	Fundamentals of Electric Circuit Theory	D. Chattopadhyaya & P. C. Rakshit, S. Chand & company, Seventh Revised Edition, 2006	10: 8121900085 13: 978-8121900089
5	Network Analysis	M.E. Van Valkenburg, Prentice Hall of India, Third Edition, 1997	13: 978-0136110958 10: 0136110959

❖ **E-REFERENCES:**

- [http:// www.allaboutcircuits.com](http://www.allaboutcircuits.com), Accessed on 18th January 2022
- https://www.youtube.com/results?search_query=resistive+networks, Accessed on 12th July 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATIONS:**

- Digital Multimeter
- Cathode Ray Oscilloscope: 0 to 20MHz
- Desktop Computer with PSPICE Software

❖ LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Prof. J. P. Kelwade	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Prof. P. H. Gedam	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip V. Darwekar	Director , Beta Computronics Pvt. Ltd.	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN AE/ME/PK/EC/MC/CM/IT/AI/MT/TX/EE
COURSE CATEGORY:	HUMANITIES AND SOCIAL SCIENCE COURSE
COURSE CODE	: AE213G
COURSE TITLE	: INDUSTRIAL MANAGEMENT **
TEACHING SCHEME:	TH:03; TU:00;PR:00(CLOCK Hrs.)
TOTAL CREDITS	: 03 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEEEXAM	: 01 Hr.(Online Examination)
PR. TEEEXAM	: --
PT. EXAM	: 30 Minutes (MCQ)

❖ **RATIONALE:**

Diploma graduate works at middle management level in the industries / engineering organizations. Therefore he has to be proficient in planning, organizing & coordinating various activities of industries s/ organizations or when he is required to work in different types of projects.

They are also expected to deal with workforce and management problems. In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. Quality and cost controls are also other important factors which contribute to the day to day supervision issues. This course aims to deal effectively with such issues along with familiarization of acts and laws applied to industries.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to

1. Use basic management principles to explore financial resources and management.
2. Use basic management principles to execute daily activities.
3. Use principles of planning and organizing for accomplishment of task .
4. Use principles of directing and controlling for implementing the plans.
5. Apply principles of safety management in all activities.
6. Apply various provisions of Industrial Acts.

❖ **COURSE DETAILS:****A. THEORY :**

Unit	Specific Learning Outcome(SLO) (Cognitive domain)	Topics and Sub-Topics	Hrs
1. Financial Management	1a. Describe given types of Ownership. 1b. Select suitable forms of ownership for given situations. 1c. Select suitable finance mode for a given venture. 1d. Compare share and debentures on given factors.	1.1 Forms of ownership Proprietorship, Partnership, Joint Stock. 1.2 Co-operative sector public sector, Govt. Undertaking Advantages Limitations & Application of each type comparison between different forms 1.3 Need of finance & sources of finance 1.4 Shares, debentures, types of shares, & comparison between shares & debentures, Break even analysis.	10
2. Introduction to Management Concepts and Managerial Skills	2a. Differentiate the concept and principles of management for the given situation. 2b. Describe functions of management for given situation. 2c. Compare the features of the given types of planning 2d. Suggest the steps in organizing in the given situation. 2e. Suggest suitable type of organization for the given example. 2f. Identify the functional areas of management for the given situation. 2g. Suggest suitable managerial skills for given situation with justification .	2.1 Definitions of management, role and importance of management. 2.2 Management characteristics and principles, levels of management and their functions; management, administration and organization, relation between management and administration. 2.3 Functions of management; planning, organizing, leading/directing, staffing and controlling. 2.4 Types of planning and steps in planning 2.5 Types of organization, Steps in organizing 2.6 Functional areas of management. 2.7 Managerial skill : Planning, decision making, problem solving and delegation	10
3. Planning & Organising	3a. Differentiate the nature of planning and planning activities for the given situation. 3b. Suggest the step wise procedure to complete the given activity in the shop floor. 3c. Select suitable forms for given activities. 3d. Prepare materials and	Planning at supervisory level 3.1 Planning by supervisor. 3.2 Planning activities, detailing and following of each step. 3.3 Prescribing standard forms for various activities. 3.4 Budgeting for materials and manpower Organizing at supervisory level 3.5 Organizing the physical resources.	08

	manpower budget for the given production activity. 3e. Describe with block diagrams the organization of the physical resources required for the given situation. 3f. Describe the human needs to satisfy the job needs for the given situation. 3g. Explain various tasks to be done by the concerned individuals for completing the given activity .	3.6 Matching human need with job needs 3.7 Allotment of tasks to individuals and establishing relationship among persons working in a group	
4. Directing and Controlling	4a. Justify the chosen need of directions and instructions to the subordinates to complete the given task. 4b. Select the feasible of instructions. to complete the given simple task, with justification 4c. Predict the possible mistakes for completing the given simple activity. 4d. Describe the managerial control actions and remedial measures required to be taken for completing the given task successfully with justification. 4e. Describe suitable control methods for given factor.	Directing at supervisory level 4.1 Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions. 4.2 Personal counseling advanced predictions of possible mistakes. 4.3 Elaborating decisions, laying disciplinary standards in overall working. Controlling at supervisory level 4.4 Managerial control; understanding team and link between various departments in respect of process and quality standards; Steps in control process. 4.5 Controlling methods; Control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, comparing with standards, correcting unfavorable deviations.	06
5. Safety Management	5a. Describe the general safety norms required to be taken in the given case. 5b. Suggest preventive measures of plant activities in the given situation. 5c. Describe the safe procedural steps required to be taken to prevent the given the type of accident. 5d. Prepare a work permit in to conduct the given maintenance activity.	5.1 Need for safety management measures 5.2 General safety norms for an industrial unit; Preventive measures. 5.3 Definition of accident, types of industrial accident, Causes of accidents 5.4 Fire hazards; Fire drill: Procedure and frequency 5.5 Safety procedure: Hazard occupational movement related to process, equipment	08

	5e. Describe the causes of the specified type of accident in the given situation. 5f. Prepare the specification of the firefighting equipment required for the given type of fire.	5.6 Work permits: Source countries migrants eligibility, age, maximum period of employment	
6. Legislative Acts	6a. Describe the purpose of the act . 6b. Describe the main provisions of the given acts and important definition.	6.1 Necessity of acts, Important definition and Main provisions of acts. 6.2 Industrial Acts : a. Indian Factory Act b. Industrial Dispute Act c. Workman Compensation Act d. Minimum Wages Act	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
NIL			

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Financial Management	02(00)	06(00)	04(02)	12(02)
2	Introduction to Management Concepts and Managerial Skills	02(00)	04(00)	04(02)	10(02)
3	Planning & Organising	02(00)	02(02)	06(00)	10(02)
4	Directing and Controlling	02(00)	04(02)	04(00)	10(02)
5	Safety Management	02(00)	04(00)	04(00)	10(00)
6	Legislative Acts	02(00)	02(02)	04(00)	08(02)
	Total	12(00)	22(06)	26(04)	60(10)

R–Remember U–Understand A–Analyze/Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Options
Q 01 To Q 35	1	R	2	1	U	2	1	U	2	1	U	2	1	A	2	30/35
	1	A	2	1	A	2	2	R	2	2	U	2	2	U	2	
	2	A	2	2	A	2	2	A	2	3	R	2	3	U	2	
	3	U	2	3	A	2	3	A	2	3	A	2	4	R	2	
	4	U	2	4	U	2	4	U	2	4	A	2	4	A	2	
	5	R	2	5	U	2	5	U	2	5	A	2	5	A	2	
	6	R	2	6	U	2	6	U	2	6	A	2	6	A	2	

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Cours e Outco mes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3, 4, 5, 6
		Class Room Assignments		Assignments	15	--	Assignment book	1, 2, 3, 4, 5, 6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1, 2, 3, 4, 5, 6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous assessment of practical	Students	End of every practical	--	--	Journal	1, 2, 3, 4, 5, 6
		Journal Writing		Assignment	--	--	Journal	1, 2, 3, 4, 5, 6
				Total	--	--		
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	Practical Answer Scripts	1, 2, 3, 4, 5, 6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4, 5, 6
	End of Course Survey			End of The Course	Questionnaires			

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	--	--	--	--	3	3	--	--
2	3	--	--	--	--	3	3	--	--
3	3	--	--	--	--	3	3	--	--
4	3	--	--	--	--	3	3	--	--
5	3	--	--	--	--	3	3	--	--
6	3	--	--	--	--	3	3	--	--

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE & TEXTBOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Industrial Engineering & Management	T.R.Banga & S.C.Sharma, Khanna Publishers, Edition-25, 2014	10:81-7409-078-9 13:978-81-7409-078-9
2	Industrial Engineering And Management	O.P.Khanna, Dhanpat Rai, New Delhi, 1980	81-885-9777-5
3	Industrial Organization and Management	Lawrence L Bethel & James L Riggs, New York, McGraw-Hill [1971], 6 th , 1979	09-322-3849-1
4	Industrial Management	I.K.Chopde & A.M.Sheikh, S.Chand & Co. Ltd, Delhi, 2 nd , 1999	81-219-1480-9
5	Industrial Engineering: Organization and Management	Tara Chand, Publisher: Nem Chand, 5 th , 1982	B0007BSSB0
6	Engineering Economics	Tara Chand, Publisher: Nem Chand, 14 th , 2014	81-85240-82-5
7	Entrepreneurial Development	S.S. Khanna, S. Chand & Co. Ltd, Delhi, 1 st , 1999, reprint 2006	81-219-1801-4

❖ **E-REFERENCES:**

- <http://www.free-management-ebooks.com/index.htm>, accessed on 18th Feb 2022
- https://www.youtube.com/watch?v=3VReVbsmjKI&ab_channel=NPTEL-NOCIITM accessed on 18th Feb 2022
- [https://www.youtube.com/watch?v=2Ie9uH9ySpo&ab_channel=Management study Guide](https://www.youtube.com/watch?v=2Ie9uH9ySpo&ab_channel=Management%20study%20Guide) accessed on 18th Feb 2022
- [youtube.com/watch?v=9QM-3LMeBQA](https://www.youtube.com/watch?v=9QM-3LMeBQA) accessed on 18th Feb 2022

❖ **LIST OF MAJOR EQUIPMENTS WITH SPECIFICATION:**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute/Industry
1	Dr.G.K.Awari	Head of the Department, Automobile Engineering Deptt.	Government Polytechnic, Nagpur.
2	Dr.R.G.Choudhary	Head of the Department, Mechanical Engineering Deptt.	Government Polytechnic, Nagpur.
3	Dr.K.S.Dixit	Sr.Lecturer in Automobile Engineering Deptt.	Government Polytechnic, Nagpur.
4	Dr.S.A.Telang	Sr.Lecturer in Automobile Engineering Deptt.	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : **DIPLOMA IN ELECTRONICS AND
TELECOMMUNICATION ENGINEERING**

COURSE CATEGORY: **ENGINEERING SCIENCE COURSE**

COURSE CODE : **IT253G**

COURSE TITLE : **PROGRAMMING IN C**

TEACHING SCHEME: **TH: 02; TU: 00; PR: 02(CLOCK HRs.)**

TOTAL CREDITS : **03(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)**

TH. TEE EXAM : **--**

PR. TEE EXAM : **02 HRs**

PT. EXAM : **--**

❖ **RATIONALE:**

Computer is a fast changing field both in software as well as hardware. Day by day more advanced software packages are being developed for Programming concepts. C being most commonly used structured programming language having powerful features compared with other existing procedural language, which will certainly help development of logical thinking abilities of the programmer, which will help him to learn any advanced object oriented of Languages.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Design algorithm and draw flowchart by using the basic entities of c language.
2. Use proper format specifiers and operators while designing the programs.
3. Write the program using appropriate branching and looping statements.
4. Apply modular programming by choosing correct type of function while writing the programs.
5. Develop programs that perform operations using arrays, strings.
6. Design the real world application using user defined data type.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Basics of Programming	1a. Enlist C tokens, keywords, various rules, symbols, data types. 1b. Identify valid / invalid variable names, syntax errors 1c. Write an algorithm and draw flowchart for simple problems. 1d. Describe structure of C program. 1e. Write program based on given data.	1.1 History of C, constants , Definition / description of program, syntax rules, character set, C tokens, keywords, identifiers, rules for identifiers, constants, types of constants, data types, size and range of data types, declaration and initialization of variables. 1.2 Definition / description of algorithm, flowchart and symbols,, High level language, Low level language , compiler, interpreter. 1.3 Structure of C program, various sections of C program and their purpose. 1.4 Process of creating, compiling and executing program. 1.5 Sample programs.	04
2. I/O , Operators and Expressions in C	2a. List various Formatted and unformatted I/O functions of C language along with syntax, its use and example. 2b. List and describe various operators. 2c. Write valid C expressions using various operators. 2d. Identify and correct the errors in expressions and statements. 2e. Write given C program using operator.	2.1 Syntax, use, examples of scanf(), printf(), getchar(), putchar(), gets(), puts() and examples, various format codes (%c, %d, %e, %f, %g, %h, %i, %o, %s, %u, %x), 2.2 Definition and example of operands, operators, expression. 2.3 Symbols, uses and examples of various Arithmetic, Relational, logical, boolean , bitwise , assignment, ternary, increment (++) and decrement (--) operators, rules for ++ , -- operators supported by C. 2.4 Writing and evaluation of arithmetic expression. Precedence of arithmetic operators, rules for evaluation of expression. 2.5 Simple C programs using various operators.	04

3. Decision Making, Branching and Looping	3a. List and write Decision making statements, unconditional jump statement, loop statements supported by C. 3b. Select and apply appropriate Decision making statements, unconditional jump statement, loop statements supported by C as per requirement. 3c. Compare various loop statements, supported by C. 3d. List rules for nesting loops. 3e. Identify and correct the errors. 3f. Write C programs using decision making and loop statements.	3.1 Syntax , working, and example of if , if- else, nested if- else , else- if ladder, switch statement, rules for switch statement, goto statement (forward jump and backward jump). 3.2 Syntax , working, comparison and example of for loop, while loop and do while loop. 3.3 Syntax , working and use of break, continue and exit(); 3.4 Programs using if , if- else, nested if- else , else-if ladder, switch statement, goto , for loop , while loop, do - while loop, nested loops .	06
4. Functions	4a. Define function and terms related to function. 4b. Enlist and define type of functions, scope rules. 4c. Enlist categories of functions and state their examples. 4d. Write the given program based on functions.	4.1 Definition / description of modular programming, User Defined Function (UDF), function prototype, local, global parameters and formal, actual arguments, Library and user defined functions, inbuilt math functions: sin(), cos(), tan(), sqrt(), pow(), log(), log10(), exp().. 4.2 Elements of UDF :function declaration, function call, function definition of UDF, return values and their types. 4.3 Function categories: function with no argument and no return value, with no argument but return value,with argument and no return value, with no argument and one return value. 4.4 Programs based on functions.	06

5. Array and Strings	5a. Define Array, string, and their related terms. 5b. Declare array and perform various operations on array. 5c. Declare and initialize various input/output functions. 5d. Declare string, perform various operations on string and use various string library functions 5e. Write programs based on arrays, strings.	5.1 Definition of subscript, subscripted variable, derived data type, array, character array, string, NULL character. 5.2 Declaration and initialization, of one dimensional array, 2D array. 5.3 Declaration, initialization of character array, using getchar(), gets(), scanf(), putchar(), puts(), printf() to input /output strings, Arithmetic operations on characters. 5.4 Syntax, working, use and examples of string handling functions like strlen(), strcpy(), strcmp(),strcat(). 5.5 Programs based on arrays, strings.	06
6. Structure and Class	6a. Define structure, class and their related terms. 6b. Design, Define, declare structure, perform operations on individual members of structure. 6c. Write a given program based on Structure and array of structures. 6d. Declare and define a class with access specifiers. 6e. Write a given program based on class.	6.1 Description of user defined data type, Structure and class variables, member operator. 6.2 Structure definition, declaration and initialization. Accessing, copying, comparing structure members, size of structure, rules for initialization of structure. 6.3 Examples of array of structures, array within structure. 6.4 Class : concepts of Object oriented programming, application, class definition with access specifier, accessing members and member function using object. 6.5 Simple program over classes and structures.	06
Total Hrs.			32

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Write and execute two simple C programs using standard formatted I/O functions . Write and execute four simple C programs using various operators and typecasting	I/O , Operators and Expressions in C	04
2	Write and execute two programs each using if - else, if – elseif ladder.	Decision Making and Branching and Looping	02
3	Write and execute two programs each using nested if- else and switch statement.		02

4	Write and execute two programs using while loop and do- while loop		02
5	Write and execute two programs each using for loop and nested for loop.		02
6	Write and execute 4 programs using function based on parameters passing by value .	Functions	04
8	Write and execute a programs using function based on recursion.		02
9	Write and execute two simple programs each using 1D and 2D arrays.	Arrays and Strings	04
10	Write and execute a simple program using character array.		02
11	Write and execute sixsimple programs each using different string library functions.		04
14	Write and execute a two simple program each using structure and array of structure.	Structure and Class	02
15	Write and execute two simple programs usingclass and creating a array of objects.		02
Total Hrs			32



❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)			Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assign-ments			Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course			Theory Answer Scripts	1,2,3,4,5,6
				Total				
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assign-ments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Writing program and Drawing flow chart	20
2	Execution of program	20
3	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	
1	3	--	--	--	--	--		--	--	
2	3	--	--	--	--	--		--	--	
3	3	--	--	--	--	--		--	--	
4	3	--	3	3	--	--		--	--	
5	3	--	3	3	--	--		--	--	
6	3	--	3	3	--	1	1	--	--	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Programming in ANSI 'C'	E. Balagurusamy , Publication Mcgraw Hill Education , 6th Edition	13, 9781259004612
2	Let us C	Yashwant Kanetkar BPB Publication , 13th Edition	13, 9788183331630
3	Complete Reference to C	Herbert Schildt, Publication Mcgraw Hill Education , 4th Edition	13 , 9780070411838
4	C Programming Language	Brian W. Kernighan, Dennis M. Ritchie, Publication Pearson , 2nd	9789332549449

		Edition	
5	C Projects	Yashwant Kanetkar BPB Publication , 4th Edition	978-8170292562
6	Exploring C	Yashwant Kanetkar BPB Publication , 3rd Edition	978-8176566339

❖ **E-REFERENCES:**

- https://onlinecourses.nptel.ac.in/noc19_cs42/preview, accessed on 21st June 2021
- <https://www.youtube.com/watch?v=0-9mRy5iNug> accessed on 21st June 2021
- <https://www.sanfoundry.com/c-interview-questions-answers/> accessed on 21st June 2021
- <https://phy.ntnu.edu.tw/~cchen/ctutor.pdf> accessed on 21st June 2021

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION :**

- Computer (Dual Core or above)
- Network printer.
- TC/GCC compiler

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. Mrs. A.R. Mahajan	Head of Information Technology	Government Polytechnic, Nagpur.
2	Mr. DipakDhote	Operations Manager, IT-Network Infosystems Pvt LTD	Industry Expert
3	Dr. Rakesh Kadu	Assistant Professor, I.T., Ramdeobaba College of Engg, and Management, Nagpur.	Member from Academics(External)
4	Mrs.V.A.Raje	Lecturer in C.O., G.P.Arvi	MSBTE Nominee
5	Mr. L.D.Vilhekar	Lecturer in Information Tech.	Member (Internal), Course Expert
6	Mrs.D.P.Chanmanwar	Lecturer in Information Tech.	Member (Internal)
7	Mr. M.N.Gawande	Lecturer in Electrical Engg.	CDC In Charge and Member Secretary
8	Mr. S. J. Pukale	Lecturer in Information Tech.	Course Expert , Reviewer

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
COURSE CATEGORY: PROGRAMME CORE COURSE
COURSE CODE : EC206G^{\$}
COURSE TITLE : LINEAR INTEGRATED CIRCUITS^{\$}
TEACHING SCHEME: TH:04; TU: 00;PR: 02(CLOCK HRs.)
TOTAL CREDITS : 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM : 03 HRs
PR. TEE EXAM : 02 HRs
PT. EXAM : 01 HR

❖ RATIONALE:

This course deals with the commonly used linear ICs like operational amplifiers, timers and PLL. More emphasis is given to the analysis of the application circuits using the IC's mentioned in various topics. This course acquaints students with general analog principles and design methodologies using integrated circuit for system design.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use IC 741 operational amplifier in linear electronic circuits.
2. Analyze different configurations of Op Amp circuit for various applications.
3. Implement various application circuits using Op-Amp.
4. Use op amp based waveform generators and special analog IC based circuits.
5. Design different op amp based filter circuits.
6. Use Timer IC 555 and PLL circuits for various applications.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Operational Amplifier	1a. Identify the given blocks in basic block diagram of op- amp. 1b. Describe the function of given terminals of op- amp. 1c. Select the parameters to be considered for given application of op amp 1d. Compare the different configurations of op- amp on the basis of given points. 1e. Identify given pins of LM324 and justify its use.	1.1 Importance of operational amplifier (op amp), Differential amplifier. Basic block diagram of op- amp. 1.2 Equivalent circuit, circuit symbols and Terminals of op-amp, Requirement of Supply voltage. Op-amp IC: 741 pin diagram and pin function. 1.3 Ideal op-amp characteristics. Study of parameters of op-amp- • Input offset voltage • Input offset current • Input bias current • Common mode rejection ratio (CMMR) • Supply voltage rejection ratio (SVRR) • Output voltage swing • Output resistance • Slew rate • Gain bandwidth product 1.4 Open loop and closed loop configuration of op-amp. 1.5 Introduction and pin diagram of IC LM324	06
2. Basic Op-amp Circuits	2a. Derive gain of given op-amp amplifiers with their circuits. 2b. Describe given op-amp differentiator/integrator. 2c. Derive the expression for output parameters of converters for given circuit.	2.1 Virtual ground concept. Circuit diagram, derivation ,working of Op- amp as an inverting amplifier , sign changer, Non-inverting amplifier, Voltage follower Inverting and non-inverting Adders (summing amplifier, scaling Amplifier, averaging amplifier)Differential amplifier (Subtractor) 2.2 Circuit diagram, derivation , working of Op-amp as Basic and Practical Differentiator, Basic and Practical Integrator 2.3 Circuit diagram, derivation ,working of Op-amp as Voltage to current converter (with floating load, with grounded load), Current to voltage converter	14

3. Special Op-amp Circuits	3a. Derive the output voltage equation for given instrumentation amplifiers. 3b. Use operational amplifier for implementation of logarithmic functions. 3c. Analyse sample and hold circuits for given parameters 3d. Select the op amp based comparators for given application with justification	3.1 Necessity and requirements of instrumentation amplifier. Instrumentation amplifiers using 2 op-amps and 3 op-amps, derivation of output voltage equation. Advantages and applications of instrumentation amplifier. 3.2 Log and antilog Amplifier, Multiplier and divider using log, antilog amplifiers. 3.3 Sample and hold circuits, advantages and applications. 3.4 Basic concepts, transfer characteristic and applications of voltage comparator. Circuit diagram, working and waveforms of • Inverting and non-inverting comparators, • Inverting and non-inverting Zero-crossing detector, • Phase detector • Peak detectors and Peak to Peak detector • Window detector	10
4. Waveform Generators and Special Analog ICs	4a. Describe the working of given oscillators and multivibrators with neat diagram and waveforms. 4b. Analyse the working of Schmitt Trigger circuit for given input parameters. 4c. Draw the voltage regulator circuits with given fixed voltage regulator ICs. 4d. Describe the function of given pins of function generator IC.	4.1 Circuit diagram, working, waveforms and application of • Wien bridge oscillator, Phase shift oscillator and Quadrature oscillator. • Op-amp as Astable, Monostable and Bistable multivibrator. 4.2 Circuit diagram, working, waveforms of Schmitt trigger circuit. Definition of Upper threshold point (UTP) and Lower threshold point (LTP). 4.3 Block diagram description, Pin diagram and circuit diagram of Fixed voltage regulator IC78xx,79xx(3-pin regulator) 4.4 Pin diagram and description, typical circuit of function generator IC8038	10

5. Active Filters	5a. Compare filters on the basis of given points. 5b. Select filters for given applications on the basis of their characteristics. 5c. Sketch the frequency responses of given types of filters. 5d. Design given types of filters.	5.1 Definition and need of filters. Classification of filters. Passive and Active filters, merits & demerits. 5.2 Terms related to filters, Cut off frequency, Pass band, stop band, center frequency, roll off rate, BW (bandwidth), Q factor. Ideal and Practical frequency response of different types of filters. 5.3 Circuit diagram ,working and design of • First order and second order low pass Butterworth filter. • First order and second order high pass Butterworth filters. • Band pass and Band stop filter	12
6. Electronic Timer and Phase Locked Loop.	6a. Identify the given internal circuits of IC555. 6b. Analyse function of given pins of IC555 6c. Analyse the working of given circuits using IC555 with neat circuit diagram and waveforms. 6d. Identify given blocks of PLL. 6e. Select PLL for given applications.	6.1 Introduction and important features of timer IC 555 , Functional block diagram and working of IC555. 6.2 Pin configuration, pin functions, specifications and applications of IC555. 6.3 Circuit diagram, working and waveforms of IC 555 based • Astable, Monostable and Bistable multivibrator • Schmitt trigger circuit • Pulse width modulator. • Voltage controlled oscillator. 6.4 Basic principle and block diagram of phase locked loop (PLL). Pin configuration of PLL IC 565 and pin functions of IC565(PLL) 6.5 Applications of PLL as frequency multiplier, FM demodulator	12
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs
1	Identify different terminals of IC 741 and IC LM324	1.Operational Amplifier	02
2	Assemble Inverting and Non-Inverting amplifier using IC 741. Determine the gain and compare it with theoretical gain.	2. Basic OP-AMP Circuits	02
3	Assemble adder / subtractor circuit using IC741 and measure the output voltage for given input voltage.		04
4	Assemble differentiator / integrator circuit using op-amp. Plot the output waveforms for sine wave and square wave input.		04
5	Assemble inverting and non-inverting comparator using Op-amp. Interpret input and output waveforms.	3.Special OP-AMP applications, comparators	02
6	Assemble circuit of astable multivibrator using IC741. Plot output waveform and determine frequency.	4. Waveform Generators and special analog ICs	02
7	Assemble circuit of Schmitt Trigger using IC741. Plot output waveform and find out UTP and LTP.		04
8	Measure time period of output waveform of Weinbridge / RC phase shift oscillator using IC 741 and find out its frequency of oscillation for various values of R.		04
9	Connect Butterworth first order low pass filter / high pass filter using op-amp and plot the frequency response.	5.Active filters and phased locked loop	04
10	Assemble circuit of Astable multivibrator using IC555. Plot output waveform and determine frequency and duty cycle.	6. Electronic timer and phased lock loop.	02
11	Measure delay time (T) of Mono stable multivibrator using IC555 and plot output waveform.		02
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Operational Amplifier	02(02)	06(03)	00(00)	08(05)
2	Basic op-amp circuits	02(02)	03(03)	06(03)	11(08)
3	Special op-amp applications and comparators	02(00)	06(00)	03(06)	11(06)
4	Waveform generators and special analog ICs	02(00)	03(06)	06(00)	11(06)
5	Active filters	02(02)	03(00)	03(03)	08(05)
6	Electronic timer and phased lock loop.	02(00)	03(03)	06(03)	11(06)
	Total	12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	5	R	2										
2	1	U	3	2	U	3	3	U	3	1	U	3	2	U	3				3/5
3	1	U	3	2	A	3	2	A	3	3	A	3	3	A	3				3/5
4	3	U	3	4	U	3	5	U	3	6	A	3	2	A	3				3/5
5	3	A	3	5	A	3	6	U	3	5	A	3	6	U	3				3/5
6	4	A	6	6	A	6	4	U	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assign-ments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assign-ments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3			3			3		
2	3			3				2	2
3	3		2	3		2	3	2	2
4	3			3				2	2
5	3		2	3	2	2	3	2	2
6	3			3	2			2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Linear Integrated circuits	S. Roy Choudhary and Jain , New age International Publishers, 4th edition ,30 July 1996	81-224-1470-2,1906574715,9781906574710
2	Integrated Circuits	K. R. Botkar., Khanna Publisher, New Delhi,5th edition,2010	81-7409-208-0.
3	Operational Amplifiers	R. Gaikwad, Prentice-hall of India New Delhi, 4th edition, January 1993	0750656948,981-240-062
4	Operational Amplifiers	Graeme and Tobey,1June 1974	978-0070649170
5	Linear Integrated Circuits	U.A. Bakshi, A.P. Godse, A.V. Bakshi	9788189411305

❖ **E-REFERENCES:**

- https://www.tutorialspoint.com/linear_integrated_circuits_applications accessed on 19 January 2022
- <https://www.electronicshub.org/ic-741-op-amp-basics> accessed on 19 January 2022
- <https://www.elprocus.com/ic-741-op-amp-tutorial-and-characteristics> accessed on 19 January 2022
- <https://electronicscoach.com/operational-amplifiers-op-amp.html> accessed on 19 January 2022
- <https://www.electronicsforu.com/technology-trends/learn-electronics/555-timer-working-specifications> accessed on 19 January 2022
- https://www.youtube.com/playlist?list=PLwjK_eyK4LLDBB1E9MFbxGCEnmM MOAXOH accessed on 21 January 2022
- <https://www.circuitlab.com/> accessed on 21 January 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Cathode ray oscilloscope- 0 to 50 MHz, Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz
2. Function Generator, 1 MHz, sine, square, triangular, ramp and pulse generator
3. Freq range 0.01 Hz to 1 MHz, Output amplitude 20V open circuited, Output impedance 50 ohms.
4. Regulated Power Supply, 0- 30 Volt, 2 A with digital display
5. AF and RF oscillator, RF frequency: 25 MHz - 50 MHz AF Frequency: 400 Hz & 1 KHz AF/ Modulating Frequency: Internal 400 Hz & 1 KHz modulating frequency
6. Pulse generator, portable, minimum frequency range-1.00-12MHz Maximum frequency range->2MHz, pulse duration <.00025microsec

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V.H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Dr. M.N. Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. Sandip V. Darwhekar	Director, Beta Computronics Pvt. Ltd.	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
6	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : **DIPLOMA IN ELECTRONICS AND
TELECOMMUNICATION ENGINEERING**

COURSE CATEGORY: **PROGRAMME CORE COURSE**

COURSE CODE : **EC207G^{\$}**

COURSE TITLE : **COMMUNICATION SYSTEMS ^{\$}**

TEACHING SCHEME : **TH:04; TU: 00;PR: 02(CLOCK HRs.)**

TOTAL CREDITS : **05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)**

TH. TEE EXAM : **03 HRs**

PR. TEE EXAM : **02 HRs**

PT. EXAM : **01 HR**

❖ **RATIONALE:**

Communication system is widely used to transfer messages from source to destination. This course deals with various communication systems that give interior and exterior communication capabilities. Microwave transmission deals with transmission of information by electromagnetic waves with wavelengths in microwave range of electromagnetic spectrum. Radar and satellite communication systems support a wide range of applications which need to satisfy a number and variety of requirements.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Test various pulse modulation techniques for suitable applications.
2. Select microwave tubes for suitable applications.
3. Interpret RADAR scanning and tracking methods.
4. Use various RADAR systems for object detection.
5. Analyse orbital parameters in satellite communication system.
6. Maintain the components of satellite subsystems.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Pulse Modulation	1a. Classify given pulse modulation techniques. 1b. Calculate sampling frequency for given frequency of signal. 1c. Use given type of pulse modulation for suitable application. 1d. Compare the performance of given pulse modulation techniques. 1e. Describe sampling and quantization process in given modulation technique. 1f. Choose suitable multiplexing techniques for given number of signal.	1.1 Introduction of pulse communication and its classification. 1.2 Pulse amplitude modulation (PAM) -Waveforms, Sampling Theorem, Nyquist Criterion, Circuit diagram of PAM modulator Circuit diagram of PAM Demodulator. 1.3 Pulse width modulation (PWM)-Waveforms, Circuit diagram of PWM modulator, Circuit diagram of PWM Demodulator. 1.4 Pulse position modulation (PPM)-Waveforms, Circuit diagram of PPM modulator, Circuit diagram of PPM Demodulator. Comparison of pulse modulation systems. 1.5 Introduction of Pulse code modulation (PCM) -quantization, quantization error, Waveforms (PCM). 1.6 Concepts of Time division multiplexing (TDM) & Frequency division Multiplexing (FDM), Comparison of TDM and FDM.	10
2. Wave Guides and Microwave Components	2a. Use microwave frequency band for given applications. 2b. Compare given types of waveguides. 2c. Calculate cut off wavelength and cut off frequency for given waveguide. 2d. Measure the output power in given Tees. 2e. Describe given cavity klystron amplifiers with neat sketch. 2f. Select given microwave tubes for suitable applications.	2.1 Wave guides –Microwave frequency spectrum and band designation. 2.2 Rectangular and circular waveguides and their applications. 2.3 The parallel plane waveguide-cut off wavelength, cutoff frequency, group and phase velocity.(Simple numerical) 2.4 Rectangular waveguide modes-TEM/TE/TM. 2.5 Waveguide components-H-plane Tee, E-plane Tee, E-H plane Tee. Multi-hole directional coupler, Isolator, Circulator. 2.6 Two cavity klystron - Applegate diagram, Multi-cavity klystron	12

		amplifier. 2.7 Reflex klystron - Working principle, schematic diagrams, 2.8 Magnetron - Working principle, schematic diagrams, advantages and disadvantages and applications.	
3. RADAR Fundamentals	3a. Describe given radar system with radar range equation. 3b. Describe given pulse radar system. 3c. Compare given types of antenna scanning methods. 3d. Describe given types of antenna tracking methods. 3e. Use given radar display method for relevant applications.	3.1 Basic Principles of Radar, Basic Radar system, Derivation of Radar range equation, Factors influencing the maximum Radar range. 3.2 Basic Pulsed Radar System – Factors governing pulse characteristics. 3.3 Radar antenna scanning methods- Horizontal, Nodding, Helical, Spiral. 3.4 Radar antenna tracking methods- Lobe switching, Conical scanning, Mono-pulse tracking. 3.5 Radar display methods - A-scope, Plan-Position Indicator.	10
4. RADAR Systems	4a. Classify given radar systems. 4b. Use given Doppler effect in given moving target indication radar. 4c. Use given CW radar systems for given applications. 4d. Use radar systems for given applications.	4.1 Pulsed radar systems- Search radar systems, Tracking radar systems, 4.2 Moving Target Indication (MTI) radar, Doppler effect, Operation of MTI radar, Delay lines, Blind speed, Radar Beacons. 4.3 CW Doppler Radar- Simple CW Doppler radar, CW Doppler radar with IF amplification, Frequency Modulated CW radar. 4.4 Advantages, Disadvantages and Applications of radar systems.	10
5. Satellite Communication System	5a. Use given satellite systems for given applications. 5b. Analyse given orbital parameters in satellite communication system. 5c. Interpret given geosynchronous satellite system. 5d. Calculate given satellite antenna look angles.	5.1 Introduction of satellites communication, General structure of a satellite communication system. Advantages of satellite communication, Kepler's Laws. 5.2 Satellite Orbits-Satellite orbital patterns, Satellite orbital terms: Apogee, Perigee, Major axis, Minor axis, Angle of inclination, Ascending node, Descending node, Line of nodes, Prograde orbit, Retrograde orbit. 5.3 Geosynchronous Satellites – requirements, Geosynchronous Satellite orbital velocity, Round trip	10

		time delay of Geosynchronous Satellite. Clark orbit, its requirements. Advantages & disadvantages of Geosynchronous Satellite. 5.4 Antenna Look Angles –Angle of elevation, Azimuth angle.	
6. Satellite Subsystems	6a. Classify given satellites on the basis of orientation. 6b. Illustrate the functions of given satellite system link models. 6c. Describe given functional stages in satellite earth station. 6d. Maintain various components of satellite subsystems.	6.1 Satellite Classifications based upon orientation- Spinner, Three axis stabilizer. Satellite Frequency Allocation, Satellite Antenna Radiation Patterns-Footprints, Spot & zonal beams, Earth global beams. 6.2 Satellite system link model-Satellite uplink model, Satellite transponder, Satellite downlink model, Inter-satellite link 6.3 Satellite Earth Station 6.4 Types of Satellite subsystems-Electric Power Supply, Altitude & Orbit Control, Propulsion, Telemetry, tracking and Command subsystem, Classify satellite based on applications.	12
		Total Hrs.	64

❖ LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Generate sampled signal for different sampling frequency and reconstruct the original information signal from samples.	Pulse Modulation	02
2	Test modulated signal for PAM and demodulate to recover the original information signal.		02
3	Test modulated signal for PWM and demodulate to recover the original information signal.		02
4	Test multiplexing of the given information signal using TDM and de-multiplexing to recover original signal.		2
5	Measure the output power in different arms of E-plane Tee / H-plane Tee / magic Tee.	Wave Guides and Microwave Components	06
6	Measure the output frequency of Reflex Klystron and sketch the waveforms.		02
7	Test performance of the waveguide coupler act as a duplexer.		02
8	Use radar system to measure the distance traveled by	RADAR	02

	any objects.	Fundamentals	
9	Use MTIRADAR to detect maximum range.	RADAR Systems	02
10	Use Doppler RADAR to detect maximum range.		02
11	Determine the velocity of moving object with the help of radar range.		02
12	Identify the various components in satellite communication model and test the functions.	Satellite Communication System	02
13	Connect the satellite system model to set direct communication link and observed the communication established to transfer audio signal.	Satellite Subsystems	02
14	To set up active satellite link and demonstrate link fail operation.		02
Total Hrs			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Pulse Modulation	02(02)	06(00)	00(00)	08(02)
2	Wave Guides and Microwave Components	02(02)	03(03)	06(03)	11(08)
3	RADAR Fundamentals	02(02)	03(06)	06(00)	11(08)
4	RADAR Systems	02(00)	03(03)	06(03)	11(06)
5	Satellite Communication System	02(00)	06(00)	00(06)	08(06)
6	Satellite Subsystems	02(00)	03(03)	06(03)	11(06)
	Total	12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

T- Unit/Topic Number

L- Level of Question

M-Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	1	U	3	1	U	3	2	U	3	2	U	3	3	U	3				3/5
3	4	U	3	5	U	3	3	U	3	3	U	3	4	U	3				3/5
4	5	U	3	6	U	3	2	A	3	2	A	3	6	U	3				3/5
5	2	A	3	3	A	3	3	A	3	4	A	3	6	A	3				3/5
6	4	A	6	6	A	6	5	A	6										2/3

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	2	-	-	2	3	-	-
2	3	-	-	-	-	-	3	-	3
3	3	-	-	3	-	2	-	-	3
4	3	-	2	3	-	2	3	-	3
5	3	-	-	3	-	-	3	-	3
6	3	-	2	3	-	-	3	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Advanced Electronic Communication Systems	Wayne Tomasi, Prentice Hall of India, Sixth Edition 2004	81-203-2497-8
2	Electronic Communication systems	Kennedy, Davis, Tata McGraw-Hill, Fourth Edition, 1999	0-07-463682-0
3	Communication Systems	R.P.Singh, S.D.Sapre, Tata McGraw-Hill, First Edition 1995	0-07-460339-6
4	Telecommunication Switching systems and Networks	T.Viswanathan, Prentice Hall of India, First Edition, 2005	81-203-0713-5
5	Satellite Communication	D.C. Agarwal, Khanna publishers, Fifth Edition, 2009	81-7409-144-0
6	Satellite Communication	Pratt, Bostian, Allnutt, Wiley Second Edition, 2006	81-265-0833-7
7	Satellite Communication	Robert Gagliardi, CBS Publication, First Edition, 2004	81-239-0919-5

8	Communication Electronics	Louis E Frenzel, Tata McGraw-Hill, Third Edition, 2002	00-704-8398-1
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❖ **E-REFERENCES:**

- <http://www.nptelvideos.in/2012/12/digital-communication.html> accessed on 2nd December 2022.
- <http://www.engineersgarage.com/tutorials/circuit-design-pulse-amplitude-demodulation>, accessed on 2nd December 2022.
- <https://www.digimat.in/nptel/courses/video/112107298/L23.html>, accessed on 2nd December 2022.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

- Digital Multi-meter 3 ¼ digit display
- Cathode ray oscilloscope- 0 to 50 MHz
- Digital Storage Oscilloscope-0 to 100MHz
- Function Generator-Frequency 10 Hz to 20 MHz.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Mrs. J. A. Raut	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mrs. U. P. Potdar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. S. V. Darvhekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Mr. K. S. Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGG
COURSE CATEGORY:	PROGRAMME CORE COURSE
COURSE CODE	: EC208G ^{\$}
COURSE TITLE	: MICROCONTROLLER ^{\$}
TEACHING SCHEME:	TH: 04; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

This course forms the foundation of Microcontroller to the students of Electronics Engineering. It deals with learning the need & concepts of different types of microcontrollers and their features related to hardware, instructions and programming. In today's era many electronic systems starting from electronic toys, house hold equipment to industry-based machines needs proper controlling as per demand. Hence, it is necessary to know the concept of controlling mechanism system. This course emphasizes on the basics of Microcontroller and its developments to controlling application of different devices interfaced in a complex system.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Compare features of various microcontrollers.
2. Detect pins of IC 8051 & hardware component inside a Microcontroller
3. Select proper instruction to develop a program for a Microcontroller based application
4. Interpret the functions of internal microcontroller peripherals,
5. Select application specific memory and peripherals for microcontroller.
6. Structure the program to interface microcontroller with different external peripherals and memory.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Introduction to Microcontrollers and Assembly Language Programming Tools.	1a. Interpret Evolution of Microcontroller. 1b. Locate different Block of Microcomputer. 1c. Discriminate elements of Microcomputer. 1d. Categories different types of buses. 1e. Compare different architecture of Microcontroller. 1f. Compare Microprocessors & Microcontrollers. 1g. Predict need of Microcontroller. 1h. Describe different family of Microcontrollers. 1i. Use specifications of various Microcontroller versions to compare them. 1j. Illustrate software development steps and tools. 1k. Describe various files created to run a 8051 program using simulators software. 1l. Use various directives in Assembly language program. 1m. Summaries the role of simulator for executing assembly language program.	1.1 Evolution of Microcontrollers 1.2 Block diagram of Microcomputer, elements of Microcomputer, types of buses 1.3 Von Neuman and Harward Architecture 1.4 Compare Microprocessor and Microcontrollers 1.5 Need of Microcontroller 1.6 Family of Microcontrollers and their specifications 1.7 Versions of Microcontroller 8951, 89C1051, 89C2051, 89C4051 with their specifications and comparison 1.8 Software development steps 1.9 Software development tools like Editor, Assembler, Linker, Loader and Hex converters. Assemblers directives: ORG, DB, EQU, END 1.10 Assembly program using simulators like RIDE or KEIL.	08
2. Architecture of Microcontroller 8051	2a. Interpret the block in the block diagram of 8051. 2b. Paraphrase the function of different blocks of 8051. 2c. Locate the pins in Pin diagram of 8051. 2d. Paraphrase the concept of Internal and External Memory. 2e. Describe reset circuitry and	2.1 Block diagram of 8051, function of each block 2.2 Pin diagram, function of each pin 2.3 Concept of Internal memory and External memory (RAM and ROM) 2.4 Internal RAM structure 2.5 Reset and clock circuit 2.6 Various registers and Introduction to SFRs of 8051	08

	clock circuitry for 8051. 2f. Categories different Registers and SFRs of 8051. 2g. Illustrate internal RAM structure of 8051.		
3. 8051 Instruction Set and Programs	3a. Classify 8051 instruction set. 3b. Use 8051 instruction format. 3c. Use addressing modes of 8051. 3d. Use instructions of 8051. 3e. Carry out addressing modes of various instructions. 3f. Practice programs for different task using various instructions. 3g. Select proper directives to develop different programs.	3.1 Assembly language Instruction format 3.2 Various addressing modes 3.3 Classification of instruction set: Data transfer, Arithmetic, Logical, Branching, Bit manipulation, stack, subroutine and interrupt related instructions. 3.4 Assembly Language Programs based on above instructions 3.5 Programs using Assembler directives.	12
4. 8051 Internal Peripherals and Related Programs	4a. Utilize the concept of I/O ports and related SFRs. 4b. Use the concept of Timer/counter and related SFRs. 4c. Use the concept of serial communication and related SFRs. 4d. Use the concept of Interrupts and related SFRs. 4e. Paraphrase the power saving modes. 4f. Practice assembly language programs using peripherals.	4.1 I/O ports- diagram, read write operation, instructions and related SFRs 4.2 Timers/counters – list, related SFRs, programming modes, operations with diagram. 4.3 Serial communication- Basics of serial communication, baud rate, related SFRs, programming modes, operations with diagram. 4.4 Interrupts- related SFRs, types, operations with diagram. 4.5 Power saving operation- modes, related SFR, 4.6 Programs for all above internal peripherals.	12
5. Introduction to External Peripheral and Memory.	5a. Classify Semiconductor memory. 5b. Carry out memory address decoding. 5c. Describe operational diagram of different I/O peripherals. 5d. Interface different peripherals with 8051. 5e. Interpret various pins of ADC and DAC.	5.1 Semiconductor memory – types, memory organization 5.2 Memory address decoding 5.3 Peripherals:-Relay,Seven segment display,LCD,4x4 Keyboard,Stepper Motor. 5.4 ADC 0808/09 5.5 DAC 0808	10
6. Interfacing 8051 With	6a. Interface given external memory with 8051. 6b. Organize memory with	6.1 Interfacing of External Data & program memory (RAM and ROM) memory map.	14

External Peripherals and Memory and Programming	address decoding diagram for given size. 6c. Practice a program related to interfacing external memory with 8051. 6d. Construct interfacing diagram of 8051 microcontroller with different I/O peripherals. 6e. Practice a programs related to interfacing of different I/O peripherals.	6.2 I/O Interfacing: -LED, Relay, Seven segment, LCD, 4x4 Keyboard, Stepper Motor. 6.3 Interfacing ADC 0808/09 6.4 Interfacing DAC 0808	
		Total Hrs.	64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Interpret various blocks on 8051 microcontroller development board.	Introduction to Microcontrollers and assembly language programming tools. 8051 Instruction set and programs	02
2	Utilize different menus available in a simulator software RIDE/KEIL and demonstrate their use.		02
3	Develop & execute Assembly language programs using Arithmetic Instructions. and demonstrate outcome for a given input.		02
4	Develop Assembly language programs using Logical Instructions and demonstrate outcome for a given input		02
5	Develop Assembly language program for Block transfer from& to Internal/External memory using directives and demonstrate outcome for a given input data		02
6	Develop Assembly language program Largest/smallest of given series of no. from Internal/External memory and demonstrate outcome for a given input data		02
7	Develop Assembly language program arrange no in ascending/descending order from Internal/External memory and demonstrate outcome for a given input data		02
8	Develop Assembly language program to generate a square by using timer delay.	8051 Internal Peripherals and related programs	02
9	Develop an ALP to transfer 8 bit data serially on serial port.		02
10	Develop Assembly language program to interface LED with microcontroller and turn it on with		02

	microcontroller interrupt.		
11	Develop Assembly language program to interface LCD with microcontroller and display the character and decimal numbers.	Interfacing and programming of 8051 microcontroller with external peripherals and memory	02
12	Develop Assembly language program to interface keyboard with 8051 and display the key pressed.		02
13	Develop Assembly language program to interface ADC with 8051 and verify input/output		02
14	Develop Assembly language program to interface DAC with 8051 and observe waveforms: square wave, triangular wave.		02
15	Develop Assembly language program to interface stepper motor to 8051 and rotate it in clockwise and anti-clockwise direction at the given angle.		04
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction to Microcontrollers and assembly language programming tools.	02(02)	03(00)	00(00)	05(02)
2	Architecture of Microcontroller 8051	02(02)	06(03)	03(00)	11(05)
3	8051 Instruction set and programs	02(02)	06(03)	03(03)	11(08)
4	8051 Internal Peripherals and related programs	02(00)	03(03)	06(03)	11(06)
5	Introduction to External Peripheral and memory.	02(00)	03(03)	06(03)	11(06)
6	Interfacing 8051 with external peripherals and memory and programming	02(00)	03(03)	06(06)	11(09)
Total		12(06)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T- Unit/Topic Number

L- Level of Question

M- Marks

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	1	U	3	2	U	3	2	U	3	2	U	3	3	U	3				3/5
3	3	U	3	3	U	3	4	U	3	5	A	3	4	U	3				3/5
4	5	U	3	6	U	3	2	A	3	5	U	3	6	U	3				3/5
5	3	A	3	4	A	3	4	A	3	3	A	3	4	A	3				3/5
6	5	A	6	6	A	6	6	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assign-ments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assign-ments	05	--	Journal	1, 2, 3,4,5,6
				Total	50	20		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	3	-	-	2	-	-	-	-	3
2	3	3	-	-	2	-	-	-	-	3
3	3	3	-	-	2	-	-	-	-	3
4	3	3	2	3	2	-	2	3	2	3
5	3	3	2	3	2	-	2	3	2	3
6	3	3	2	3	2	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	The 8051 Microcontroller and Embedded systems using Assembly Language and C. 2/E	Mazidi, Pearson Education, Asia 2007, Second Edition.	8131710262, 9788131710265
2	The 8051 Microcontroller, Architecture, Programming and Application.	Kenith Ayala, Penram International Publications. 1996	9780314201881
3	Microcontrollers: Theory and Applications.	Ajay V Deshmukh, McGraw Hill Education India.	9780070585959, 9780070585959
4	Microcontroller Principal and Application	Pal, Ajit PHI Learning, New Delhi	9788120343924
5	Microcontroller Architecture Programming, Interfacing and System	Raj Kamal Pearson Education, Delhi 2012	9788131759901

	Design		
6	Microprocessor and Microcontroller: Architecture programming and system Design	Krishna Kant PHI Leaning New Delhi 2016	9788120348530

❖ **E-REFERENCES:**

- <https://www.win.tue.nl/~aeb/comp/8051/set8051.html> accessed on 7th Oct 2022
- <https://www.elprocus.com/8051-microcontroller-architecture-and-applications/> accessed on 7th Oct 2022
- <http://www.iust.ac.ir/files/ee/pages/az/mazidi.pdf> accessed on 7th Oct 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Trainer Board for 8051 Microcontroller.
2. Development Board for 8051 Microcontroller.
3. Digital Multi-meter
4. Computer Machine with Installation of Kiel Simulator

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	HOD in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
2	Dr. V. H. Mankar	HOD in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
3	Mr. D. B. Alaspure	Lecturer in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
4	Ms. S. S. Pampattiwar	Lecturer in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
5	Mr. Sandip V. Darwhekar	Director, Beta Computronics Pvt. Ltd., Nagpur	Beta computronics Pvt Ltd, Nagpur
6	Mrs. Gazala Ali	Head of Electronics and Telecommunication Engg.	Anjuman Polytechnic, Nagpur
7	Mr. Kapil Pachpor	Lecturer, in Electronics and Telecommunication Engg..	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : **DIPLOMA IN ELECTRONICS & TELECOMMUNICATION ENGG**

COURSE CATEGORY: **PROGRAMME ELECTIVE COURSE**

COURSE CODE : **EC209G^{\$}**

COURSE TITLE : **VLSI AND VHDL PROGRAMMING^{\$}**

TEACHING SCHEME: **TH: 03; TU: 00; PR: 02(CLOCK HRs.)**

TOTAL CREDITS : **04(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)**

TH. TEE EXAM : **03 HRs**

PR. TEE EXAM : **02 HRs**

PT. EXAM : **01 HR**

❖ **RATIONALE:**

In the present scenario of electronic technology, CMOS plays an important role in designing/development of products ranging from consumer to industrial and Telecommunication engineering area. Functional capabilities of this technology lead to very large-scale integration. Therefore, imparting knowledge of VLSI and its tools is a need of today. This course is introduced with a view that students will be able to be developed digital logic system using VHDL. Students will be able to develop VHDL code by using CAD tool like text editor, design entry, compiling, simulation, synthesis, analysis, programming etc.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to—

1. Develop model of Moore and Mealy machine.
2. Implement CMOS logic and logical equations.
3. Comprehend Hardware description language, its components and programming Syntax.
4. Develop program to implement combinational and sequential logic circuit using VHDL.
5. Comprehend VHDL simulation and synthesis.
6. Comprehend ASIC, FPGA and PLDs.

❖ COURSE DETAILS:

A. THEORY:

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs .
1. Advanced Digital Design	1a. Differentiate between asynchronous and synchronous logic circuit for the given parameters. 1b. Develop the state diagram, state table for the given sequential logic. 1c. Develop model of Moore and Mealy machine of the given contents. 1d. Solve examples for Moore and Mealy counters.	1.1 Review of sequential logic: Asynchronous and synchronous, Metastability, Noise margin, Power Fan-out, Skew (Definition Only). 1.2 Moore and Mealy Models, state machine notation. 1.3 Example on Moore and mealy: counter, sequence detector only. 1.4 ASIC design flow 1.5 CPLD -Xilinx and Atmel series architecture, Details of internal block diagram 1.6 Introduction to FPGA like Xilinx (FPGA), SPARTAN 3 series and Atmel	06
2. Introduction to VLSI Technology	2a. Compare the performance of BJT and CMOS for the given parameter. 2b. Describe the given MOS fabrication process. 2c. Compare nwell, pwell, twin tub process. For the given points. 2d. Compare NMOS, PMOS and CMOS for the given parameter. 2e. Calculate the estimation of resistance and capacitance layout.	2.1 Introduction of BJT and CMOS parameter. 2.2 Fabrication process: overview of wafer processing, oxidation, epitaxy, deposition, Ion-Implementation and diffusion, silicon gate process. 2.3 Basic of NMOS, PMOS and CMOS: nwell, pwell, twin tub Process. 2.4 Estimation of resistance and capacitance layout	08
3. Logic Design Using CMOS	3a. State the representation of symbol using MOS device for designing basic logic gates. 3b. State CMOS logic concept. 3c. Construct basic gates using CMOS inverters. 3d. Construct basic gates using NOR, NAND.	3.1 Combinational Logic based on MOS devices 3.2 CMOS logic gate concept 3.3 Basic gates using CMOS inverter, NOR NAND 3.4 MOS transistor switches, transmission gates, 3.5 CMOS inverter characteristics. 3.6 Complex logic using CMOS	08

	3e. List CMOS inverter characteristics. 3f. Construct complex logic using CMOS.		
4. Introduction: Hardware Description Language (HDL)	4a. Discuss, Pros and Cons of VHDL. 4b. Describe Hardware description language, its components and programming syntax. 4c. Describe the given VHDL flow elements. 4d. Describe the use of given data type declaration in VHDL. 4e. Describe the given type of VHDL modeling.	4.1 Introduction to HDL: History of VHDL, Pros and Cons of VHDL 4.2 VHDL Flow elements (Entity, Architecture, configuration, Package, Library only definitions. 4.3 Data Types, operators, operations 4.4 Signal, constant and variables (syntax and use) 4.5 VHDL, Modeling: -Data flow, Behavioral, Structural.	10
5. VHDL Programming	5a. Develop program using concurrent statements for the given application in VHDL. 5b. Develop program using sequential statements for the given application in VHDL 5c. Develop program to implement the given combinational/sequential logic circuit using VHDL. 5d. Describe the test bench for the given application in VHDL.	5.1 Concurrent constructs (when, with, process) 5.2 Sequential Constructs (process, if, case, loop, assert, wait) 5.3 Simple VHDL program to implement Flip Flop, Counter, shift register, MUX, DEMUX, ENCODER, DECODER, MOORE, MEALY machines 5.4 Test bench and its applications	10
6. Simulation and Synthesis	6a. Compare software and hardware description language on a given points. 6b. Compare event based and cycle-based simulators on the given points. 6c. Describe VHDL simulation for the given application. 6d. Draw HDL design flow of synthesis for the given application.	6.1 Event scheduling, sensitivity list, zero modeling, simulation cycle, Comparison of software and hardware description language, delta delay 6.2 Types of simulator event based, and cycle based. 6.3 HDL Design flow for synthesis 6.4 Efficient Coding Styles, optimizing arithmetic expression, sharing of complex operator	06

	6e. Describe use of efficient coding style, optimizing expression, sharing of complex operator.		
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify various Pins for FPGA and CPLD ICs using educational kits.	1	02
2	Install EDA tool for VLSI application.	2	02
3	Develop VHDL code for all basic logic gates and simulate using Xilinx tool.	4	02
4	Develop VHDL code for adder / subtractor using data flow modeling and simulate using Xilinx tool.	4	02
5	Develop VHDL code for 8:1 multiplexer / 1:8 decoder using when else statement and simulate using Xilinx tool.	5	02
6	Develop VHDL code for 8:3 encoder / 3:8 decoder using with select statement and simulate using Xilinx tool	5	02
7	Develop VHDL code for 7 Bit Odd / Even Parity Generator. and simulate using Xilinx tool	5	02
8	Design 4-bit adder using 1 bit adder using structural modeling.	5	02
9	Design 4-bit BCD to GRAY code converter using VHDL. Analyze the results.	5	02
10	Develop VHDL code tri state buffer using process statement. Apply the test inputs and analyze the waveforms.	5	02
11	Develop VHDL code for D flip-flop with asynchronous reset. Apply the test inputs and analyze the waveforms.	5	02
12	Develop VHDL code for JK flip-flop with synchronous reset. Apply the test inputs and analyze the waveforms.	5	02
13	Develop VHDL code for 4-bit UP counter. Apply the test inputs and analyze the waveforms.	5	02
14	Develop VHDL code for 4-bit DOWN counter using T flip flop. Apply the test inputs and analyze the waveforms.	5	02

15	Develop VHDL code for Mealy / Moore FSM to detect the sequence 1101(overlapping allowed).	6	02
16	Develop VHDL code for all logic gates and simulate using Xilinx tool.	6	02
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Advanced digital design	02(02)	00(00)	00(00)	02(02)
2	Introduction to VLSI Technology	02(05)	09(03)	00(00)	11(08)
3	Logic design using CMOS	05(02)	06(06)	00(00)	11(08)
4	Introduction: Hardware Description Language (HDL)	02(00)	03(06)	06(00)	11(06)
5	VHDL Programming	02(00)	06(06)	06(00)	14(06)
6	Simulation and Synthesis	05(00)	06(00)	00(06)	11(06)
	Total	18(09)	30(21)	12(06)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	2	U	3	2	U	3	2	U	3	2	U	3	2	R	3				3/5
3	3	U	3	3	U	3	3	R	3	3	U	3	3	U	3				3/5
4	4	U	3	5	U	3	5	U	3	4	U	3	4	U	3				3/5
5	6	U	3	6	U	3	6	R	3	5	U	3	5	U	3				3/5
6	4	A	6	5	A	6	6	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Classroom Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment, writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1	3	3	-	-	2	-	-	-	-	3
2	3	3	-	-	2	-	-	-	-	3
3	3	3	-	-	2	-	-	-	-	3
4	3	3	2	3	2	-	2	3	2	3
5	3	3	2	3	2	-	2	3	2	3
6	3	3	2	3	2	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	VHDL Design	Bhaskar J Pearson Education India 2011	9780130965752
2	VHDL programming with Example	Douglas Perry Tata Mcgraw Hill 4 th Edition 2003	9780071400701.
3	VLSI design and EDA Tools	Sarkar and Sarkar Scitech Publications (India) Pvt Ltd 2013	13: 978-0-07-059357-2
4	VHDL Basics to programming	Kaur Gaganpreet Pearson Education India 2011	9788131732113
5	Xilinx Manual	Xilinx	www.xilinx.com
6	CMOS VLSI Design: A Circuits and Systems Perspective	Neil H. E. Weste & David Money Harris 4 th Edition Pearson New international	13. 978-0321547743

❖ **E-REFERENCES:**

- VHDL Tutorial - Introduction to VHDL for beginners - Nandland <https://nandland.com> › introduction-to-vhdl-for-beginners 30-Jun-2022.
- VHDL Tutorial: Learn by Example <http://esd.cs.ucr.edu> › labs › tutorial
- See All Tutorials > - Xilinx <https://www.xilinx.com> › support › self-paced-tutorials Oct 2022
- Principles of VLSI Design - ECE UNM <http://ece-research.unm.edu> › vlsi Oct 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Personal Computer with latest configuration
2. FPGA Trainer kit with accessories
3. VLSI Trainer kit necessary accessories
4. JTAG Cable, Multimeter, Breadboard
5. Xilinx/Altera EDA Tool

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	HOD in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
2	Dr. V. H. Mankar	HOD in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
3	Mr. D. B. Alaspure	Lecturer in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
4	Ms. S. S. Pampattiwar	Lecturer in Electronics and Telecommunication Engg.	Government Polytechnic, Nagpur
5	Mr. Sandip V. Darwhekar	Director , Beta computronics Pvt Ltd, Nagpur	Beta computronics Pvt Ltd, Nagpur
6	Mrs. Gazala Ali	Head of Electronics and Telecommunication Engg.	Anjuman Polytechnic, Nagpur
7	Mr. Kapil Pachpor	Lecturer, in Electronics and Telecommunication Engg..	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY:	PROGRAMME ELECTIVE COURSE
COURSE CODE	: EC210G^{\$}
COURSE TITLE	: PYTHON PROGRAMMING^{\$}
TEACHING SCHEME:	TH: 03; TU: 00; PR:02 (CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

Engineering students should know the basics of python programming in open source environment. Python programming course is designed for students to enrich the knowledge of different Python terminology. This course covered Python fundamentals including OOPS concepts. The course has been designed in such a way that a student can handle both the Front-end and Back-end development processes. This course takes you through a hands-on guide to object-oriented, exception handling, internet services feature of Python. It gives detailed primer on database programming with Python, installing a SQLite server and performing routine data selections and operations for developing applications.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Display message on screen using Python script on IDE.
2. Develop Python program to demonstrate use of operators.
3. Perform operations on data structure in Python.
4. Develop Python functions for given problem.
5. Design Python classes for given problem.
6. Handle exceptions in Python file management.

❖ **COURSE DETAILS:**❖ **THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Introduction and Syntax of Python Program	1a. Identify the given variables, keywords, and constants in Python. 1b. Use identification, comments in the given program. 1c. Install the given Python IDE and editor. 1d. Develop the Python program to display the given text.	1.1 Features of Python — Interactive, Object-oriented, Interpreted, platform independent 1.2 Python building blocks Identifiers, Keywords, Indentation, Variables, Comments 1.3 Python environment setup Installation and working of IDE 1.4 Running Simple Python scripts to display 'welcome' message. 1.5 Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Declaration and use of data types	04
2. Python Operators and Control Flow Statements	2a. Write simple Python program for the given arithmetic expressions. 2b. Use given types of operators for writing the arithmetic expressions. 2c. Write a Python program using decision structure for two-way branching to solve the given problem. 2d. Write a Python program using decision structure for multi-way branching to solve the given problem.	2.1 Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence 2.2 Control Flow: 2.3 Conditional Statements (if, if ... else, nested if) 2.4 Looping in python (while loop, for loop, nested loops) 2.5 Loop manipulation using continue, pass, break, else.	06
3. Data Structures in Python	3a. Write Python program to use and manipulate lists for given problem. 3b. Write Python program to use and manipulate tuples for given problem. 3c. Write Python program to use and	3.1 Lists: – Defining lists, accessing values in list, deleting values in lists, updating lists. – Basic list operations – Built-in list functions 3.2 Tuples: – Accessing values in tuples, deleting values in tuples and updating tuples. – Basic Tuples operations.	12

	manipulate sets for given problem. 3d. Write Python program to use and manipulate Dictionaries for given problem.	– Built-in tuple functions. 3.3 Sets: – Accessing values in sets, deleting values in sets and updating sets. – Basic sets operations. – Built-in set functions. 3.4 Dictionaries: – Accessing values in Dictionary, deleting values in Dictionary, updating Dictionary. – Basic Dictionary operations. – Built-in Dictionary functions.	
4. Python Functions, Modules and Packages	4a. Use the Python standard functions for the given problem. 4b. Develop relevant user defined functions for the given problem using Python code. 4c. Write Python module for the given problem. 4d. Write Python package for the given problem.	4.1 Use of Python Built-in functions (e.g. type/data conversion functions, math functions etc.) 4.2 User defined functions: Function definition, function calling, function arguments and parameter passing, Return statement, Scope of variables: Global variable and Local variable. 4.3 Modules: Writing modules, importing modules importing objects from modules, Python built – in modules(e.g. Numeric and mathematical module, Functional Programming module), Namespace and Scoping. 4.4 Python Packages: Introduction, Writing Python packages, Using Standards (e.g. math, scipy, Numpy, matplotlib, pandas, etc) and user defined packages.	12
5. Object Oriented Programming in Python	5a. Create classes and objects to solve the given problem. 5b. Write Python code for data hiding for the given problem. 5c. Write Python code using data abstraction for the given problem. 5d. Write Python code using inheritance for the given problem.	5.1 Creating Classes and Objects. 5.2 Method overloading and overriding. 5.3 Data hiding. 5.4 Data abstraction. 5.5 Inheritance and composition classes. 5.6 Customization via inheritance specializing inherited methods.	08
6. File I/O Handling and Exception	6a. Write Python code for the given reading values from keyboard.	6.1 I/O Operations: Reading keyboard input, printing to screen. 6.2 File Handling: Opening file in different mode, accessing file	06

Handling.	6b. Read data from the given file. 6c. Write the given data to a file. 6d. Handle the given exceptions through Python program.	contents using standard library functions. Reading and writing files, closing files, renaming and deleting files, directories in Python, File and Directory related standard functions. 6.3 Exception handling: Introduction, Exception handling – ‘try: except:’ statement, ‘raise’ statement, user defined exceptions.	
		TOTAL	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Install and configure Python IDE.	1. Introduction and Syntax of Python Program	02
2	Develop and execute simple Python program to display message on screen.		02
3	Develop and execute simple Python program using operators: a) Arithmetic operators b) Logical operators c) Bitwise operators	2. Python operators and Control Flow statements	02
4	Develop and execute simple Python program to demonstrate use of conditional statement: a) ‘if’ statement b) ‘if.....else’ statement c) Nested ‘if’ statement		02
5	Develop and execute Python program to demonstrate use of looping statements: a) ‘while’ loop b) ‘for’ loop c) Nested loops		02
6	Develop and execute Python program to perform following operations on Lists: a) Create List b) Access List c) Update List (Add item, remove item) d) Delete List	3. Data structures in Python	02
7	Develop and execute Python program to perform following operations on Tuples: a) Create Tuple b) Access Tuple c) Update Tuple d) Delete Tuple		02

8	Develop and execute Python program to perform following operations on Sets: a) Create Set b) Access Set elements c) Update Set d) Delete Set		02
9	Develop and execute Python program to perform following operations on Dictionaries: a) Create Dictionary b) Access Dictionary c) Update Dictionary d) Delete Dictionary e) Looping through Dictionary		02
10	Develop & Execute Python program to demonstrate math built-in functions. (Any two programs)	4. Python functions, modules and packages	02
11	Develop & Execute user defined Python function for given problem: (a) Function with minimum two arguments. (b) Function returning values.		02
12	Develop & Execute Python program to demonstrate use of: a) Built-in module (e.g. keyword, math, number, operator) b) User defined module.		02
13	Develop & Execute Python program to demonstrate use of: a) Built-in packages (e.g. Numpy, Panda) b) User defined packages.		02
14	Develop & Execute python program to demonstrate following operations: a) Method Overloading b) Method Overriding	5. Object Oriented Programming in Python	02
15	Develop & Execute python program to demonstrate following operations: a) Simple Inheritance b) Multiple Inheritance		02
16	Develop & Execute python program to handle user defined exceptions for given problem.	6. File I/O handling and Exception handling.	02
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction and Syntax of Python Program	02(02)	00(00)	00(00)	02(02)
2	Python operators and Control Flow statements	02(05)	03(03)	03(00)	08(08)
3	Data structures in Python	02(02)	03(03)	06(03)	11(08)
4	Python functions, modules and packages	05(00)	06(03)	06(03)	17(06)
5	Object Oriented Programming in Python	02(00)	06(06)	06(00)	14(06)
6	File I/O handling and Exception handling	02(00)	06(03)	00(03)	08(06)
	Total	15(09)	24(18)	21(09)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER :**

T-Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	2	U	3	3	U	3	4	U	3	2	U	3	2	R	3				3/5
3	4	R	3	4	U	3	2	A	3	3	U	3	3	A	3				3/5
4	6	U	3	3	A	3	5	U	3	4	U	3	4	A	3				3/5
5	5	U	3	6	U	3	3	A	3	6	U	3	6	A	3				3/5
6	5	A	6	6	A	6	5	U	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Correctness of program logic	10
2	Debugging ability	20
3	Viva voce	10
4	On time term work submission	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	3	--	-	3	--	3
2	3	3	3	3	2	-	3	--	3
3	3	-	3	3	--	-	3	--	3
4	3	3	3	3	--	-	3	--	3
5	3	3	3	3	2	-	3	--	3
6	3	-	-	3	--	-	3	--	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Python Programming	Rao, K. Nageswara, Sheikh Akbar	9789385983450
2	Learning Python,	Mark Lutz , O'Reilly , 5th Edition , 2013	13 : 9780596158064
3	Python Essential Reference	Beazley, David	13: 9780672329784
4	Head-First Python	Paul Barry, O'Reilly , 2nd Edition , 2016	13: 9781491919538
5	Learn Web Development with Python: Get hands-on with Python Programming and Django web development	Fabrizio Romano, Packt, 1 st edition, 2018	13: 9781789953299

❖ **E-REFERENCES:**

- <https://www.guru99.com/python-tutorials.html>, Accessed on 25 Jan. 2022
- <https://docs.python.org/3/tutorial/>, Accessed on 25 Jan. 2022
- <https://www.tutorialspoint.com/python/index.html>, Accessed on 25 Jan. 2022
- <https://nptel.ac.in/courses/106/106/106106145/>, Accessed on 25 Jan. 2022
- <https://www.udemy.com/course/python-the-complete-python-developer-course/>, Accessed on 25 Jan. 2022
- <https://www.udemy.com/course/complete-python-bootcamp/> Accessed on 25 Jan. 2022
- https://spoken-tutorial.org/tutorial-search/?search_foss=Python+3.4.3&search_language=English Accessed on 25 Jan. 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

- Computer (Dual Core or above)
- Network printer.
- TC/GCC compiler

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecommunication Engineering	Government Polytechnic, Nagpur
2	Dr. V. H. Mankar	Head of Electronics & Telecommunication	Government Polytechnic, Nagpur
3	Prof.S. S. Pampattiwar	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur
4	Prof. S. M. Kale	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Nagpur
5	Mr. S. V. Darwhekar	Director, Beta Computronics Pvt. Ltd., Nagpur	Beta Computronics Pvt. Ltd., Nagpur
6	Mrs. Gazala Ali	HOD in Electronics & Telecomm. Engineering	Anjuman Polytechnic, Nagpur
7	Prof. Kapil Pachpore	Lecturer in Electronics & Telecomm. Engineering	Government Polytechnic, Amravati

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMM. ENGG.
COURSE CATEGORY	: PROGRAMME ELECTIVE COURSE
COURSE CODE	: EC211G^{\$}
COURSE TITLE	: OPTICAL COMMUNICATION ^{\$}
TEACHING SCHEME	: TH:03; TU:00;PR:02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCKHR.)
TH. TEE	: 03 HRs
PR.TEE	: 02 HRs
PT.	: 01 HR

❖ **RATIONALE:**

Fiber optics technology is increasingly replacing conventional wire-transmission lines. Realizing its fast growing importance, the electronics engineer must know the basic principles of fiber optics communication system. This course will provide basic concepts and requisite knowledge and skill required for optical fiber communication system. This course also deals with various applications of fiber optics cable along with different optical component use in the design of optical communication link.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply the fundamental principles of optics and light wave to design optical fiber communication systems.
2. Categorize different optical fiber cable construction and its characteristics.
3. Classify different losses in fiber optic communication link.
4. Analyse attenuation and dispersion losses in optical fiber communication.
5. Use different types of optical components in optical fiber link.
6. Measure attenuation and optical power using optical measuring equipment.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Basics of Light wave	1a. Identify different frequency bands in Electromagnetic spectrum. 1b. State and define basic optical laws. 1c. Describe the block diagram of optical communication. 1d. Identify different parameters of optical fiber. 1e. State advantages and disadvantages of optical communication. 1f. Select optical fiber cable for specific application.	1.1 Electromagnetic spectrum and optical spectral bands. 1.2 Basic optical laws and definitions. 1.3 Basics of light and its quantum nature. 1.4 Block diagram of optical communication link (analog and digital). 1.5 Advantages and disadvantages of optical communication. 1.6 Applications of optical fiber Communication.	10
2. Fundamentals of Optical Fibers	2a. Apply concept of basis laws to understand light propagation in optical fiber. 2b. Derive equation for NA. 2c. Classify different types of fibers. 2d. Construct fiber optic cable and identify different layers. 2e. Describe Graded index Fiber. 2f. Analysis , Define the single mode and multimode fibers. 2g. Compare different types of fibers base on refractive index profile. 2h. Solve numerical on NA for given fiber optic cable.	2.1 Propagation of light in an optical fiber. 2.2 Total internal reflection, acceptance angle, numerical aperture (NA) and mathematical derivation of NA. 2.3 Phase and group velocity, cutoff wavelength and group delay. 2.4 Basics of Optical fiber structure 2.5 Classification of optical fibers according to material used, refractive index profile. 2.6 Step index fiber and graded index fiber. 2.7 Single mode and multimode -fibers. 2.8 Numerical on NA, acceptance angle and critical angle.	08

3. Losses In Optical Fiber	3a. Describe various losses in optical communication. 3b. Compute Bending loss in given optical fiber cable. 3c. Show difference between Micro bending and macro bending loss. 3d. Distinguish between intramodal and intermodal dispersion. 3e. Describe types of dispersion. 3f. Define material dispersion and its effect on Maximum transmission rate. 3g. Compare different dispersion losses in optical fiber. 3h. Solve numerical on signal attenuation for given fiber optic cable.	3.1 Signal degradation in optical fiber, Attenuation, attenuation units. 3.2 Material Absorption losses in optical fiber. Intrinsic absorption and extrinsic absorption. 3.3 Linear Scattering losses and Nonlinear Scattering losses. Rayleigh Scattering and Mie Scattering 3.4 Fiber bends loss. Types: - Macro-bends and Micro-bend losses. Material or impurity losses. 3.5 Radiation induced losses, transmission losses Inherent defect losses, temperature dependence of fiber losses, core and cladding losses. 3.6 Dispersion, signal distortion in optical fibers. Types of dispersion:- Intra modal dispersion(chromatic dispersion) and Intermodal dispersion Types of intra modal dispersion:- material dispersion and waveguide dispersion 3.7 Total dispersion delay, maximum transmission rate. 3.8 Numerical on signal attenuation.	08
4. Optical Sources for Transmission.	4a. Define Spontaneous and stimulated emission. 4b. Analyse and define different terms related to semiconductor physics. 4c. Describe importance of wavelength and material use in optical source. 4d. Compare Spontaneous and stimulated emission on the basis energy band diagram. 4e. State the working principle of LED. 4f. Describe operation of LASER . 4g. Illustrate different LED on basis of construction. 4h. Compare performance of different LED. 4i. Identify advantages and disadvantages of LED. 4j. Construct block diagram	4.1 Light emission – spontaneous emission, stimulated emission, forbidden energy gap. 4.2 Basics of semiconductor physics:- Energy bands, direct and indirect band gaps, pn junction, light source materials. 4.3 Introduction to optical sources:- wavelength and material consideration 4.4 Light emission theory:-stimulated emission, spontaneous emission. 4.5 LED:- principle of working and characteristic. 4.6 Concept of DH-LED. 4.7 Types of LED: Surface emitter LED and edge emitter LED, working principle of these LEDs 4.8 Advantages and disadvantages of LED 4.9 Principle working of semiconductor injection LASER and its characteristics.	08

	of LASER. 4k. Draw Characteristics of LASER and LED. 4l. Construct block diagram of LASER and LED transmitter.	4.10 Comparison of LED and LASER 4.11 LED transmitter circuit for analog and digital signal 4.12 LASER transmitter circuit for analog and digital signals	
5. Optical Detectors and Receivers	5a. State different requirements and basic detection principle of optical detector 5b. Define Dark current noise, thermal noise. 5c. Show Photo emissive, photo conductive and photo voltaic effect with example. 5d. Compare different photodiode on the basis of performance. 5e. Describe operation of Photodiodes. 5f. Construct block diagram of optical receiver and Describe it operation. 5g. Analyze different receiver noise. 5h. Construct optical receiver circuit using APD and PIN diode. 5i. Describe how repeaters are use in optical fiber link.	5.1 Requirements for detectors and materials used. 5.2 Optical detection principle 5.3 Photo emissive, photo conductive and photo voltaic principle 5.4 Principle, working , characteristic of p-n diode, PIN photodiode and Avalanche photodiode(APD) 5.5 Comparison of above photodiodes 5.6 Optical Receiver operation. 5.7 Receiver noise: thermal noise, dark current noise and quantum noise 5.8 Block diagram of optical receiver circuit using APD and PIN photodiode 5.9 Need of repeater in fiber optical link.	08

6. Optical Components and Measurements	6a. Select different types of optical component to construct optical link. 6b. Describe role of connector on optical link. 6c. Interpret Splicing process for optical fiber cable. 6d. Illustrate basic concept behind integrated optics and optical amplifiers 6e. Describe different measuring equipment use in optical communication. 6f. Describe how different parameter can be measure on field. 6g. Analysis of different methods use for measurement of losses using OTDR.	6.1 Different optical components like coupler and its types: directional coupler, star coupler. 6.2 Optical Connectors and its types. 6.3 Splicing and its types: electric arc fusion splicing and mechanical splicing 6.4 Concepts of integrated optics and optical amplifiers 6.5 Introduction to optical Measurement 6.6 Equipment used in field testing 6.7 Optical power method , cutback method, insertion loss method, analysis using OTDR	06
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Observe the input and Output waveforms on CRO by using 650nm optical fiber as a analog link.	Light waves and basics of optical fiber	02
2	Observe the Input and Output waveforms on CRO by using 650nm optical fiber as a digital Link.		02
3	Measure the value of NA and observe the effect of diameter of optical fiber on NA values.	Light waves and basics of optical fiber	02
4	Measure the loss occurred due to bending of fiber using Optical power meter.	Fiber losses and dispersion in optical fiber	02
5	Measure Propagation loss or Attenuation loss in an optical fiber by measuring input voltage and output voltage.	Fiber losses and dispersion in Optical fiber	02
6	Set up a voice communication link through optical fiber using amplitude modulation.	Optical sources and transmitter	02
7	Observe the effect of intensity modulation of analog signal by transmitting it over optical fiber cable and demodulate the same at the receiver.	Optical sources and transmitter	02

8	Identify various connectors used for optical communication system.	Optical Components and Measurements	02
9	Perform mechanical splicing for connecting two optical fibers.	Optical Components and Measurements	02
10	Measure propagation loss due to connectors and couplers using optical power meter.	Optical Components and Measurements	02
11	Prepare Report on Visit to optical fiber section at BSNL office.		06
12	Prepare Report on Various Optical Couplers and Connectors.		06
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Light waves and basics of optical fiber	02(00)	03(03)	00(00)	05(03)
2	Classification and losses Of Optical Fibers	02(02)	03(03)	06(00)	11(05)
3	Dispersion losses in optical fiber	02(00)	03(03)	06(06)	11(09)
4	Optical sources and transmitter	02(02)	06(03)	03(03)	11(08)
5	Optical Detector and receivers	02(00)	06(03)	03(03)	11(06)
6	Optical components and measurements	02(02)	03(03)	06(00)	11(05)
	Total	12(06)	24(18)	24(12)	60(36)

R– Remember

U–Understand

A – Analyze /Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	4	R	2	6	R	2										
2	1	U	3	2	U	3	3	U	3	1	U	3	2	U	3				3/5
3	4	U	3	4	U	3	5	U	3	3	U	3	4	U	3				3/5
4	5	U	3	6	U	3	4	A	3	5	U	3	6	U	3				3/5
5	5	A	3	6	A	3	6	A	3	4	A	3	5	A	3				3/5
6	2	A	6	3	A	6	3	A	6										2/3

T-Unit/Topic Number
R-RememberL- Level of Question
U-UnderstandM- Marks
A-Analyze/ Apply

**ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Sheets	1, 2, 3,4,5, 6
		Class Room Assignments		Assignments	15	--	Assignment Book / Sheet	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Sheets	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Rubrics &Assessme nt Sheets	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Rubrics & Practical Answer Sheets	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, writing observation table, draw waveforms and writing procedure etc.	10
2	Performance of the practical	20
3	Taking observations ,Calculation, Result, Drawing Graphs (if any)	10
4	Viva-voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	-	3	3		-	-	-	3	-
2	-	3	3	-	-	-	-	3	-
3	-	3	3	-	-	-	-	3	-
4	-	3	3	2	-	-	-	3	2
5	-	3	3	2	-	-	-	3	2
6	-	3	3	2	-	-	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXTBOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Optical fiber communication	Gerd Keiser, McGraw hill education (India) pvt. Ltd. 2008	9780072321012
2	Optical Fiber communication	John M. Senior, Pearson education ltd,2009, 3rd edition	9788131732663

❖ **E-REFERENCES:**

- <http://nptel.ac.in/courses/117104127> , accessed on 20 January ,2022
- <http://www.electronicsforu.com> , accessed on 20 January ,2022
- <https://www.youtube.com/watch?v=7h2xr-pi5VQ> , accessed on 20 January ,2022
- <http://ofcvlab.vesit.ves.ac.in>, accessed on 21 January ,2022.

❖ **LIST OF MAJOR EQUIPMENTS / INSTRUMENTS WITH SPECIFICATION:**

- Digital Multi-meter, Optical Power meter
- Cathode Ray Oscilloscope (0-50MHZ), OTDR
- Function Generator

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	HOD, Electronics and Telecommunications	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Mr. Sachin M. Kale	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mrs. U. M. Ramteke	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip Darvekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

**PROGRAMME : DIPLOMA IN ELECTRONICS AND
TELECOMMUNICATION ENGINEERING**

COURSE CATEGORY: PROGRAMME ELECTIVE COURSE

COURSE CODE : EC212G^{\$}

COURSE TITLE : COMPUTER COMMUNICATION NETWORK ^{\$}

TEACHING SCHEME: TH: 03; TU: 00; PR: 02(CLOCK Hrs.)

TOTAL CREDITS : 04 (1 TH/TU CREDIT = 1 CLOCK HR., 2 PR CREDIT = 1 CLOCK HR.)

TH TEE : 03 HRs

PR TEE : 02 HRs

PT EXAM : 01 HR

❖ **RATIONALE:**

The future of computer technology is in computer networks. Global connectivity can be achieved through computer networks. A Computer networks has been growing with rapid technological progress. Computer communication through networking becomes essential part of our life. We can manage many application like Air Line Reservation, Railway Reservation, E-banking, E-Governance, On-Line shopping , E-learning etc. by clicking mouse button from our own place. A diploma holder in Mechatronics engineering should therefore understand the function of networks. Knowledge about hardware and software requirements of networks is essential.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Analyze the functioning of data communication and computer network
2. Use LAN network for sharing different devices like printer , scanner.
3. Apply the different types of network topologies for internet connection.
4. Identify various transmission media for data transmission.
5. Select the protocol for network layer.
6. Install TCP/IP Protocol and configure its features.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Concept of Data Communication	1a. Identify components of data communication. 1b. Compare analog and digital signal on the given points. 1c. Select the signal for given data transmission rate .	1.1 Definition of data communication & its type- Local and Remote Basic concept of Components of data communication-Message, sender, Receiver,. Medium for Signal Propagation. 1.2 Definition and waveform of Analog and Digital signals. 1.3 Data transmission rate and bandwidth of signal.	04
2. Basic Network	2a. Identify components of given computer network. 2b. Describe benefits of given computer networks. 2c. Classify networks on basis of given parameter.	2.1 Fundamentals of Computer Network-Definition, Need of Components of Computer Network, Network Applications, 2.2 Network Benefits-Sharing Information-File Sharing, E-mail Sharing Resources– Printer Sharing, Application Services Facilitating Centralized Management-Managing Software, Maintaining the Network, Backing up data 2.3 Computer Network Classifications-Classification of Network by their Geography.- PAN, CAN, LAN, MAN, WAN Classification of Network by their Component Role Peer-to- Peer Network, Server-Based Network	10
3. Network Topologies & Networking Devices	3a. Design computer network for particular topology. 3b. Identify the network control device with their need. 3c. Select the network control device for given applications.	3.1 Network Topologies - Introduction, Definition, Selection Criteria,Types of Topology- Bus topology,Ring topology,Star topology Mesh topologyTree topology Hybrid topology 3.2 Network Control /Connecting Devices-Need of Network Control devices, Role of network control device in network, connectors Repeater, Bridges, Switches, Hub, Router, Gate way, Modem	08

4. Transmission Media	4a. Identify transmission media for relevant applications. 4b. Identify cables for guided media. 4c. Select the unguided media for given communications. 4d. Describe latest technology for given wireless network.	4.1 Introduction - Need of Transmission Media, Selection Criteria, Types of Transmission Media 4.2 Guided Media: Cable Characteristics, Types of Cable- Twisted Pair Cable, Co-axial Cable, Fibre Optic Cable. 4.3 Unguided media: Types of Communication Band- Microwave Communication, Radio wave Communication, Satellite Communication, Infrared Communication. 4.4 Latest Technologies in Wireless Network-Bluetooth Architecture, Wi-Fi, Wi- Max.	08
5. OSI Reference Model	5a. Classify OSI layer on given parameters. 5b. Identify Layers of given OSI reference model. 5c. Select the protocol for given Layer.	5.1 Definitions of OSI Model, Characteristic of OSI Model. 5.2 Types of OSI Layer Data link layer, network layer, Session layer, Application layer 5.3 Function of OSI Layer. Protocol used in Layer, transmission control Layer and user datagram Protocol	08
6. TCP/IP Suite	6a. Select Layered structure of TCP/IP model for relevant application. 6b. Compare IPv4 and IPv6 on given point. 6c. Select required protocol for data transfer in network for various application. 6d. Compare OSI and TCP/IP network model on basis of given point.	6.1 Introduction –Addressing mechanism in the Internet IP-internet protocol Application of TCP / IP Protocol Suite : Host-to-Network–SLIP- Serial line internet protocol and PPP- point to point protocol, Internet Layer- address resolution protocol - ARP,RARP 6.2 IP: Introduction-Internet Protocol version 4-IPv4, IPv6, Difference between IPv4 & IPv6.Transport Layer- TCP and UDP 6.3 Application Layer- FTP- file transfer protocol , SMTP- simple mail transfer protocol , DNS-domain name system 6.4 Comparison between OSI and TCP / IP Network Model.	10
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Sr. No.	Title of Practical/Lab. Work/Assignments	Units	Hrs.
1	Identify different Components of Network in your Computer Network Lab.	1. Concept of data communication	02
2	Share different devices like printer, scanner etc. over LAN network	2. Basic network.	02
3	Using a Hub/ Switch Install a LAN network consisting of 6 computers.		02
4	Connect computer in star topology by using wired media or with any network device (e.g. Hub)	3. Network topologies & networking devices	02
5	Connect two hubs/switch by creating crossover connection		02
6	Share a printer on a network and print a document from different computer on a network		04
7	Install server software and device driver software.		02
8	Identify different transmission media like cables & connectors.	1. Transmission media	02
9	Interconnect two PCs using RS232 cable and transfer data as null modem configuration.		04
10	Configure Peer-to-Peer Network.	5. OSI reference Model	02
11	Install TCP/IP Protocols and configure advanced features of TCP/IP Protocols.	6. TCP/IP Suite	04
12	Mini Project: Prepare detailed report of existing LAN in the Department/Institute		04
Total			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Concept of Data Communication	02(02)	06(03)	00(00)	08(05)
2	Basic Network Concepts	02(02)	03(03)	06(03)	11(08)
3	Network topologies and Networking devices	02(02)	03(00)	03(03)	08(05)
4	Transmission media	02(00)	03(06)	06(00)	11(06)
5	OSI reference model	02(00)	06(00)	03(06)	11(06)
6	TCP/IP suite	02(00)	03(03)	06(03)	11(06)
	Total	12(6)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	1	U	3	2	U	2	4	U	3	1	U	3	2	U	3				3/5
3	1	U	3	2	A	3	3	U	3	2	A	3	3	A	3				3/5
4	2	A	3	3	A	3	4	U	3	5	U	3	6	A	3				3/5
5	6	U	3	5	A	3	4	A	3	5	U	3	6	U	3				3/5
6	5	A	6	6	A	6	4	U	6										2/3

T- Unit/Topic Number
R-RememberL- Level of Question
U-UnderstandM- Marks
A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Connection of computer in LAN , installation of printer, software etc.	20
2	Configure and installation of test networking device	20
3	Viva voice	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	-3	-	-
2	3	-	-	3	-	-	-	-	-
3	3	-	-	3	-	-	3	-	-
4	3	-	-	3	-	-	-	-	-
5	3	-	-	3	-	-	3	-	-
6	3	-	-	3	-	-	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Data Communications and Networking	Behrouz A. Forouzan, Tata McGraw Hill, Forth Edition, 2009	0072967757, 9780072967753
2	Data communication and computer network	Michael Duck, Pearson Education 2009	9788131726082
3	Data Communication & Networking	Achyut S. Godbole, Tata McGraw-Hill, Edition, 2011	1259084671, 9781259084676
4	Computer Networking	Tularam M Bansod, Dreamtech Press, 2013	9789351192084

❖ **E-REFERENCES:**

1. <https://www.omnisci.com/technical-glossary/network-topology> accessed on 18 Jan 2022
2. <https://www.geeksforgeeks.org/difference-between-lan-and-wan/?ref=lbp> accessed

on 18 Jan 2022

3. <https://www.elprocus.com/what-is-transmission-media-in-computer-networks-its-types/> accessed on 18 Jan 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Network Lab with all PC connected in LAN
2. Network cable connectors(Cat 5/Cat 6/C2G, RJ45,RJ11)
3. Network Lab via Cable or WIFI
4. Layer 2 Switch ,Hub(16 I/O)
5. 24 port Switches, Wi-fi Modems, Router, Firewall

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Mrs. P. H. Gedam	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. D. B. Alaspure	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Shri. Sandip V. Darwekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Prof. Kapil Pochpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC251G
COURSE TITLE	: ELECTRONIC WORKSHOP
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04(CLOCK Hrs.)
TOTAL CREDITS	: 02(1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: 02 HRs
PT. EXAM	: --

❖ **RATIONALE:**

This subject enhances the technician skill development in electronics engineering. It deals with application of different test and measuring instruments and electronic workshop tools used in the production of electronic gadgets. It explores various aspects and levels of electronic gadget fabrication packaging and presentation skills. The course deals with hands on practice and industrial methods of electronic equipment production and its budgeting and economics.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Use datasheet of components.
2. Test different electronics components.
3. Operate electronics workshop tools.
4. Prepare plan for the job work to be done.
5. Prepare mini project of electronic Gadget.
6. Troubleshoot electronic devices like Function Generator, CRO etc .

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Hrs.
1	Collect the information of following tools • Nose pliers • cutter • stripper • soldering gun • de-soldering pump • De-soldering braid • Temperature controlled soldering station • Hot air gun • And high speed drill Machine.	04
2	Operate following test and measuring equipments referring user's manual. • Multimeter, • LCR Q meter • Analog and digital IC tester, • Cathode Ray Oscilloscope (CRO)	04
3	Test resistor, capacitor, inductor by using Multimeter, LCR Q meter and CRO.	04
4	Test diode, transistor, switches and connectors by using Multimeter.	02
5	Test Analog and Digital IC by using IC tester.	02
6	Practice soldering & Desoldering on zero Printed Circuit Board (PCB)	04
7	Identify faults in given power supply • Identify different sections • Trace voltage regulation section in given power supply • Measure Voltage at test points in given power supply • Use service manual.	06

8	Identify faults in given function generator • Identify different sections • Trace alternation section used in function generator • Measure Voltage at test points in given power supply • Use service manual.	04
9	Identify faults for given CRO • Identify different sections • Trace vertical section in CRO • Measure Voltage at test points in given CRO • Trace Signal in CRO at different sections • Use service manual.	06
10	Create layout of circuit using PCB design software, setting up PCB work place component positioning and placement option , setting up the design rule, positioning the component on PCB , changing a foot print , routing the board manually and automatically.	04
11	Prepare PCB • Test visually with magnifier lens. • Perform Continuity and short circuit test of tracks. • Test Component with LCR Q meter, IC Tester, Multimeter. • Verify specifications, rating, package type, equivalency of component by referring data sheet. Use various connectors, berg- strip (male, female) whenever necessary.	06
12	Test SMD components and SMD PCB	02
13	Mount and solder the Components on PCB and Perform Continuity and short circuit test.	04
14	Mini Project • Select the project based on course - • Prepare flow chart (action plan) for mini project and procure different components for selected mini project with brief Project Report.	06
15	Test and troubleshoot the circuit for specific function. Check different parameters like • input ,output signals • voltages • current • Frequency at various test points.	06
Total Hrs.		64

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressiv e Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignme nts		Continuous	--	--	--	--
	TEE	End Exam	Student s	End of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Skill Assesse ment	Students	Continuous	20	--	Rubrics & Assesse ment Sheets	1, 2, 3, 4,5,6
		Journ al Writi ng		Continuous	05	--	Journal	1, 2, 3, 4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Student s	End of the Course	50	20	Rubrics & Practica l Answer Sheets	1, 2, 3, 4,5,6
Indirect Assessment	Student Feedback on course		Student s	After First Progressi ve Test	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment, identify component , writing procedure etc.	10
2	Performance/Create PCB layout using software /Testing component /Operating & Troubleshooting of equipments.	20
3	Calculation, Result, Drawing Graphs, report writing (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	2	-	-	-	-	-	-	-	-
2	-	2	3	-	-	-	-	-	-
3	-	3	3	-	-	-	-	-	-
4	-	3	3	2	-	-	-	3	2
5	-	3	3	2	-	-	-	3	3
6	-	3	3	2	-	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXTBOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Printed Circuit Boards: Design, Fabrication, Assembly and Testing	R. S. Khandpur ,Tata McGraw- Hill Education, 1 st edition,2005	13:9780071464208 10:0071464204
2	PCB Design & Technology	W. C. Bosshart, Tata McGraw Hill , 2 nd edition ,1983	10:0074515497
3	Printed Circuits Handbook	Clyde Coombs , Happy Holden, 7th Edition	978-0071467346

❖ **E-REFERENCES:**

1. https://en.wikipedia.org/wiki/Electronics_For_You accessed on 22nd Oct, 2022.
2. https://blogs.keysight.com/blogs/tech/bench.entry.html/2021/03/15/troubleshooting_with-JqMR.html accessed on 22nd Oct, 2022.
3. <https://electricalnotebook.com/lcr-q-meter/> accessed on 22nd Oct, 2022.
4. <https://www.cirexx.com/pcb-design-steps/> accessed on 22nd Oct, 2022.

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. LCR Q meter
2. Digital Multi-meter
3. CRO
4. Function Generator

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.R.V.Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr.V.H.Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Prof.P.H.Gedam	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Shri. Sandip Darwekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs.Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
6	Prof. Kapil Pochpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

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COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC301G^{\$}
COURSE TITLE	: DIGITAL COMMUNICATION^{\$}
TEACHING SCHEME	: TH:04 ; TU:00;PR:02(CLOCK HRs.)
TOTAL CREDITS	: 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE.	: 03 HRs
PR. TEE	: 02 HRs
PT.	: 01 HR

❖ **RATIONALE:**

Our aim is to achieve the vision of Digital India, where every Indian is digitally empowered and every information is digitally available. The role of Electronics and Telecommunication student is important in perceiving Digital India concept. In order to meet the prerequisites, this course focuses on fundamental concepts of digital modulation, digital transmission, multiplexing, data communication circuits, basic networking fundamentals such as error control, protocols that are pillars of Digital Communication. Study of Digital Communication for Electronics and Telecommunication students offers an opportunity to transform themselves into digital enterprises.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Apply the fundamental principles Digital communication to understand the basics of digital Communication system.
2. Decide the digital modulation technique, data transfer technique for specific application.
3. Interpret various line coding formats in digital communication system.
4. Identify different multiple access techniques.
5. Apply basics of Data communication in understanding the various data communication

systems/use the concept of data communication for diff applications.

6. Use Spread Spectrum Techniques for high security of data.

❖ **COURSE DETAILS:**

A. THEORY

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Basics of Digital Communication	1a. Compare Analog and Digital Communication. 1b. Identify missing block in the basic block diagram of digital communication system. 1c. State Sampling theorem. 1d. State the effect of Quantization error on different modulation techniques. 1e. Describe Block diagram of companding. 1f. Justify “ How ADM is better than DM and PCM”. 1g. Compare various modulation techniques	1.1 Comparison between Analog and Digital Communication 1.2 Block diagram of digital Communication system, Advantages and Disadvantages of digital communication 1.3 Sampling theorem, Nyquist rate, aliasing 1.4 Quantization, Quantization error 1.5 Companding-Block diagram of analog, digital companding 1.6 Block diagram and operating principles of PCM, DPCM, DM, ADM transmitter and receiver 1.7 Comparison between above modulation techniques	10
2. Digital Modulation Techniques	2a. Describe Block diagram of various digital modulation technique. 2b. Describe block diagram of QPSK with the help of waveforms. 2c. Describe block diagram of QAM. 2d. Compare various digital modulation techniques	2.1 Basic Digital Modulation Techniques:-Block diagram, working and waveforms of Amplitude Shift Keying(ASK), Frequency shift keying(FSK), Binary Phase shift keying(BPSK) transmitter and receiver, Phaser diagram, constellation diagram and Bandwidth considerations of BPSK 2.2 Quaternary Phase Shift Keying, Block diagram of QPSK, Offset, QPSK (OQPSK), 8-PSK transmitter and receiver, Waveforms, Phaser diagram,	12

		constellation diagram Bandwidth considerations of QPSK , 8-PSK, Quadrature Amplitude Modulation, Block diagram of 8- QAM transmitter ,receiver, Phaser diagram , constellation diagram of 8-QAM 2.3 Comparison of digital modulation techniques	
3. Information Theory And Coding	3a. Solve Numericals on Information theory, Entropy, Information Rate 3b. Define Baudot and ASCII code. 3c. Draw various line coding format for given digital data. 3d. Describe different Channel encoding techniques.	3.1 Information theory, Amount of information, Entropy, Information Rate ,Huffman coding, Shannon's theorems of channel capacity Channel noise and its effects (Numerical on 3.1) 3.2 Baudot code, ASCII code , 3.3 Digital carrier line encoding-Factors for selecting line coding format-Waveforms of Unipolar, Polar RZ, Polar NRZ , Biphasic:- Manchester and differential Manchester Numericals on 3.3 3.4 Channel encoding -Error detection :Vertical redundancy check(VRC) , Longitudinal redundancy check (LRC) ,Checksum , Cyclic redundancy Checking (CRC)-Error correction : Retransmission , Forward error correction-Hamming Codes	12
4. Multiplexing and Multiple Access	4a. State need of Multiplexing. 4b. Describe block diagram of DS-0-level. 4c. Describe various digital carrier system with the help of block diagram. 4d. Compare various multiple access techniques.	4.1 Need and Types of multiplexing 4.2 TDM-Block diagram of single channel (DS-0-level) PCM , transmission system 4.3 T1 ,T2,T3 digital carrier systems 4.4 Digital carrier frame synchronization 4.5 Bit and word interleaving 4.6 Access Techniques:- Need and Methods- Time Division Multiple Access (TDMA), Frequency Division Multiple Access(FDMA),	08

		Code division Multiple Access(CDMA) , Comparison of above Multiple access.	
5. Fundamentals of Data Communication	5a. List various standards for data communication. 5b. Describe block diagram of data communication. 5c. Draw Data format of character synchronization 5d. Compare Two and Multipoint Data communication circuits. 5e. Identify the missing block in UART transmitter or receiver. 5f. Describe RS-232 Electrical Equivalent Circuit. 5g. Identify Missing block in asynchronous FSK Modem	5.1 Introduction to Data Communication, Standard organization for data communication 5.2 Basic block diagram of data communication circuit , Serial and parallel data transmission , Data communications circuit arrangements 5.3 Character Synchronization: Asynchronous serial data , synchronous serial data 5.4 Block Diagram of Data communication hardware, Two point and Multipoint data communication Circuits 5.5 Line Control Unit(LCU) , UART:- LCU -UART interface, signals, Block diagram of UART transmitter , UART transmitter signal sequence, UART receiver, UART receiver Signal sequence, Start bit verification circuit 5.6 RS-232 electrical equivalent circuit. 5.7 Data communication Modem, Block diagram of an asynchronous FSK modem	14
6. Spread Spectrum Modulation	6a. Describe block diagram of SS Modulation. 6b. Define Pseudo Noise sequence. 6c. Describe Block diagram of various SS system. 6d. Justify “how SS modulation is helpful in providing security to data”.	6.1 Introduction to Spread Spectrum (SS) Modulation, Block diagram of Spread, Spectrum Modulation System. 6.2 Pseudo Noise Sequence:- Definition Generation of Pseudo-Noise (PN) sequence , Maximum Length Sequence. 6.3 Types of SS:- Direct sequence , Spread Spectrum (DSSS):- Block diagram transmitter/encoder ,	08

		Frequency Hop Spread Spectrum (FHSS):- Block diagram of transmitter and receiver, Slow frequency Hopping and Fast frequency hopping 6.4 State advantages and disadvantages of Spread Spectrum methods, Applications of Spread Spectrum modulation	
		Total Hrs	64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Test the sample and hold circuit for various sampling frequencies to check the sampling theorem.	Basics of Digital Communication	02
2	Check the performance of Pulse code modulator /DPCM modulator and Demodulator.		02
3	Check the performance of Delta Modulator/ Adaptive Delta Modulator.		04
4	Check the performance of ASK/FSK/PSK modulator and demodulator.	Digital modulation Techniques	04
5	Check the performance of QPSK/ 8- QAM/16-QAM modulator and demodulator OR Test the circuit for carrier and clock recovery.		04
6	Check the performance of Pulse code modulator and Demodulator for error detection and correction (Parity and hamming codes).	Information theory and coding	02
7	Test the TDM Transceiver for multiplexing two or more signals.	Multiplexing and Multiple Access	02
8	Test the line encoder circuit for various line encoding Formats.		02
9	Collect information and compare performance parameters of various Codec ICs for general operation / features of codec/filter combo chips.		02
10	Transfer the data using RS-232 standards/UART technique/Prepare data transfer cable using RS-232 Standards.	Fundamentals of Data Communication	02
11	Check the performance of bit synchronizer / carrier synchronizer / MODEMS.		02
12	Prepare a report on Spread Spectrum Modulation and its applications.	Spread Spectrum Modulation	04

Total	32
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❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Basics of Digital communication	02(02)	06(00)	03(03)	11(05)
2	Digital modulation Techniques	02(00)	09(00)	06(00)	17(00)
3	Information theory and coding	02(02)	00(03)	06(03)	08(08)
4	Multiplexing and Multiple Access	02(02)	00(06)	03(00)	05(08)
5	Fundamentals of Data Communication	02(00)	09(09)	00(00)	11(09)
6	Spread Spectrum Modulation	02(00)	00(00)	06(06)	08(06)
	Total	12(06)	24(18)	24(12)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	3	R	2	4	R	2										
2	1	U	3	2	U	3	5	U	3	1	A	3	3	A	3				3/5
3	1	U	3	2	U	3	5	U	3	3	U	3	4	U	3				3/5
4	5	U	3	2	U	3	1	A	3	4	U	3	5	U	3				3/5
5	3	A	3	3	A	3	4	A	3	5	U	3	5	U	3				3/5
6	2	A	6	6	A	6	6	A	6										2/3

T -Unit/Topic Number
R-RememberL- Level of Question
U-UnderstandM- Marks
A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Who m	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	Progressive Test (PT)	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Sheets	1, 2, 3
		Assignmen ts		Continuous	15	--	Assignme nt Book / Sheet	1, 2, 3
	E (Term End)	End Exam	Students	End of the Course	60	24	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessmen t	Students	Continuous	20	--	Journal	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				Total	25	10		
	E (Term End Examinati	End Exam	Student s	End of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect Assessment	Student Feedback on course		Student s	After First Progressi ve Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing block diagram, selection of equipments / Trainer kit, writing procedure etc.	10
2	Performance-Connecting Equipments/Trainer kit, Identification of different sections of given trainer kit OR Obtaining waveforms of input, output or different testing points OR Testing ,Exploring different parameters of given trainer kit	10
3	Result, Drawing Waveforms(if any),Analyzing waveforms	10
4	Viva voce	20
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	3	3
3	3	-	-	-	-	-	-	-	-
4	3	-	-	3	-	-	-	3	3
5	3	-	-	3	-	-	2	3	3
6	3	-	-	3	-	-	2	3	3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

❖ **REFERENCE and TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Electronic Communications Systems	Wayne Tomasi ,Pearson Education, Fifth Edition, 2009	978-81-317-1953-4
2	Principle of communication systems	Donald L. Schilling, Goutam Saha, Herbert Taub, Tata McGraw-Hill Education Pvt. Ltd, Fourth Edition, 2015	10: 1259029859 / 13: 9781259029851

3	Data and Computer Communication	William Stallings, Pearson Education, Eighth Edition, 2008	0-13-243310-9
4	Computer Networks	Andrew S. Tanenbaum/David J. Wetherall, Pearson, Fifth Edition, 2014	9789332518742
5	Digital communication	John Proakis and Masoud Salehi Digital Communications, Fifth Edition, 2007	13: 978-0072957167 10: 0072957166
6	Digital Communication	Amitabha Bhattacharya, Tata Mcgraw Hill, First Edition, 2011	13: 9780070591172 10: 0070591172/

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=xltpukBncs8> accessed on 11th March 2022
- <https://www.youtube.com/watch?v=ifgs0uypC78> accessed on 11th March 2022
- <https://www.youtube.com/watch?v=ZDFJqOTbSmE>, accessed on 11th March 2022
- <http://computer.howstuffworks.com/serial-port1.htm> , accessed on 11th March 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. Spectrum analyzer, Max. 1.5 GHz Frequency Range
2. DSO-100 MHz
3. CRO – Dual trace, 20 MHz Bandwidth
4. Function Generator: Frequency Range 0.1 Hz to 1 MHz.
5. RF generator/wideband oscillator Wide Frequency Range 100 KHz to 150MHz.
6. Digital Communication Trainer System for various Modulations and Demodulations: ASK, FSK, BPSK, QPSK, 8-PSK, 16-QAM
7. Digital Communication Trainer System for PCM/ Delta/Adaptive Delta/DPCM Modulation/Transmitter and Demodulation /Receiver
8. Digital Communication Trainer System for TDM , Spread spectrum System , Modem, Serial/Parallel data Transmission

❖ **LIST OF EXPERTS AND TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Mrs. U. P. Potdar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. S. M. Kale	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip V. Darwhekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC302G^s
COURSE TITLE	: WIRELESS COMMUNICATION^s
TEACHING SCHEME	: TH:03; TU: 00;PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ RATIONALE:

The glorious 21st century marks the wireless communication industry by order of magnitude. Wireless communication provides connectivity with mobility, flexibility and convenience. Wireless devices are used across the various industries like Healthcare, Education, Automation, Renewable energy sector, Automobile etc. Effective use of social networking has become possible due to high end wireless devices. This course will help the students to develop skills to handle wireless and mobile communication systems

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Use the fundamental principles of wireless communication to understand wireless communication system.
2. Analyze the functions of mobile unit and mobile antenna.
3. Identify different handoff strategies.
4. Assess performance of standards of different cellular mobile system.
5. Select relevant wireless technology suitable for various applications.
6. Analyze the performance of various wireless IEEE standards.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1. Introduction to Wireless Communication System	1a. Describe the evolution of the mobile system. 1b. List various Mobile standards. 1c. Describe Cordless cellular system. 1d. State and define base station, control station, forward channel, reverse channel. 1e. Justify Importance of Hexagonal Shaped cells. 1f. State the role of engineers in planning of cellular system.	1.1 Introduction to wireless communications. Evolution of Wireless communication. 1.2 Major Mobile radio Standards in world (AMPS, N-AMPS, IS-95, GSM, CDMA 2000) 1.3 Mobile wireless systems: Cordless Telephone System and Cellular Telephone System. 1.4 Wireless communication system definitions: - base Station, Control Channel, forward channel, reverse channel, Mobile Station, Mobile Switching center, 1.5 Concept of hexagonal shaped cells. 1.6 Planning of cellular system Engineers role in planning of Cellular System	06
2. Mobile Phone handset and Mobile Antenna	2a. Identify missing block in block diagram of mobile handset. 2b. Describe block diagram of various block in mobile unit. 2c. State features of SIM. 2d. Describe Mobile antenna.	2.1 Block diagram of mobile unit and operation of mobile unit 2.2 Block diagram and operation of Frequency synthesizer, transmitter, receiver, logic unit, control unit and handset 2.3 Subscriber's Identification Module (SIM) and its features. 2.4 Mobile antennas:-Roof Mounted, Glass mounted, Mobile High-Gain antennas	05

3. Cellular Concepts	3a. State the problem with cellular system. 3b. State the importance of cell. 3c. Describe cellular mobile radio system. 3d. State how the frequency reuse concept helps in improving the spectrum utilization. 3e. Compare different interference in cellular system. 3f. Justify how Splitting of cell increase the capacity of cellular system. 3g. State the Importance of HO. 3h. Justify how delaying of HO leads to proper HO. 3i. Describe type of HO.	3.1 Limitations of conventional mobile telephone system, Problems with Cellular System. 3.2 Cellular Concept fundamentals:- Cell, Cell Structure, Cluster 3.3 A basic Cellular System, Operation of Cellular system 3.4 Concept of frequency reuse channel, frequency reuse schemes, frequency reuse distance, number of customer in the system. 3.5 Interference and system capacity, Co-Channel interference, adjacent channel Interference, interference reduction factor. 3.6 Improving coverage and capacity in cellular system:- cell splitting, Permanent Splitting and Dynamic Splitting, Sectoring, Microcell Zone concept. 3.7 Concept of Handoff:- Need of handoff, types of handoff:- Hard and Soft handoff .Initiation of a Handoff. 3.8 Handoff Strategies, Prioritizing Handoffs, Practical Handoff considerations, Delaying a handoff, advantage of Delayed handoff, 3.9 Types of Handoff:-Forced Handoff, Controlling a Handoff, Creating a Handoff. Queuing of handoff, Power Difference handoff. Mobile Assisted Handoff (MAHO),Cell-Site Intersystem handoff	13
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4. Digital Cellular Mobile Standard	4a. Describe GSM system Architecture. 4b. Identify various GSM channels. 4c. Compare GSM with CDMA. 4d. Describe block diagram of SS7 protocol Architecture. 4e. List services of SS7. 4f. Describe an Example SS7.	4.1 Global System for mobile (GSM):-Services and Features, 4.2 GSM System Architecture, Radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM. Security and privacy in GSM 4.3 IS-95/CDMA features and Channel specifications. Comparison with GSM standards. 4.4 Signaling System no. 7(SS7):- Network Services part (NSP) of SS7, Message Transfer part (MTP) 4.5 SS7 user Part, Signaling traffic in SS7, SS7 services and performance 4.6 Global Cellular Network interoperability an Example of SS7	10
5. Modern Wireless Communication Systems	5a. State the Need of 3G and 4G. 5b. State the features of IMT 2000. 5c. List features of UMTS. 5d. Describe system architecture of CDMA 2000. 5e. Identify missing block in block diagram of LMDS. 5f. Justify how 5G is better than 4G.	5.1 Need For 3G and 4G technology 5.2 IMT 2000 global standards: Vision, Compatibility, services and spectrum requirements. 5.3 W-CDMA (UMTS) features, UMTS air Interface specification, 5.4 3G CDMA 2000, features, System Architecture, spectrum requirements. Comparison of 3G WCDMA and 3G CDMA 2000. Comparison of CDMA and GSM standard. 5.5 Wireless Local Loop(WLL) and Local Multipoint Distribution(LMDS):- Block Diagram. 5.6 Introduction to 5G, Features and Specification	08
6. Modern Wireless Networks	6a. Select suitable IEEE standard for an specific application. 6b. State importance of RFID tags. 6c. Describe WLAN system architecture. 6d. List Features of IEEE802.16 standard.	6.1 Bluetooth and Personal Area Network:- Features, Architecture, frequency band, advantages, IEEE standard 6.2 RFID Concept, Frequency band, classification of RFID tags, applications. 6.3 WLAN technology: IEEE	06

	6e. State the need of adhoc network. 6f. Describe architecture of MANET.	802.11, system architecture , radio spectrum 6.4 WMAN :-IEEE 802.16 and 802.16a Wimax, Features, applications 6.5 Concept of Adhoc Network, Characteristics of Adhoc Network, Ability if Adhoc Network, 6.6 Mobile Adhoc Networks (MANET):-Features , architecture, applications	
		Total Hrs.	48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Identify different sections and components of mobile phone such as ringer section , dialer section, receiver section, transmitter section, camera, microphone, speaker , flashlight.	1	02
2	Use the Mobile Kit to Observe and Analyze the Mobile is powered ON at the alarm set Time.	2	02
3	Measure the value of power supply used in mobile System.	2	02
4	Use the CRO to observe the audio signal in mobile system using mobile kit.	2	02
5	Measure the voltage at SIM supply and at other pins of SIM using multimeter.	2	02
6	Connect the CRO to observe the SIM clock and measure the voltage at SIM Clock using Multimeter.	2	02
7	Verify and analyze the intensity in hardware control of mobile system	3	02
8	Identify the fault inserted in keypad of mobile System.	4	02
9	Identify the fault in LCD in mobile system.	4	02
10	Observe and analyze the charging phenomena with fault insertion in mobile system.	4	02
11	Prepare a report on Industrial visit to mobile CDMA company or GSM Company OR Prepare a report on CDMA and GSM mobile by using video CD.	5	04

12	Prepare a report on survey of various wireless networks.	6	04
13	Prepare report on survey of different mobile service provider.	6	04
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction to Wireless communication system	02(02)	03(03)	00(00)	05(05)
2	Mobile Phone handset and Mobile antenna	02(00)	00(06)	03(00)	05(06)
3	Cellular Concepts	02 (02)	09(00)	06(03)	17(05)
4	Digital Cellular Mobile standards	02(02)	06(00)	06(06)	14(08)
5	Modern Wireless Communication System	02(00)	03(03)	06(03)	11(06)
6	Modern Wireless Networks	02(00)	03(06)	03(00)	08(06)
	Total	12(06)	24(18)	24(12)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T -Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	3	R	2	4	R	2										
2	1	U	3	3	U	3	6	A	3	2	U	3	1	U	3				3/5
3	3	U	3	4	U	3	4	U	3	5	U	3	6	U	3				3/5
4	5	U	3	3	A	3	2	A	3	3	A	3	5	A	3				3/5
5	3	A	3	6	U	3	3	U	3	2	U	3	6	U	3				3/5
6	4	A	6	5	A	6	4	A	6										2/3

T - Unit/Topic Number

L - Level of Question

M - Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment	CA (Continuous)	Progressive Test (PT)	Students	Two PT (average of two tests)	25	--	Test Answer Sheets	1, 2, 3
		Assignments		Continuous	15	--	Assignment Book / Sheet	1, 2, 3
	TEE	End Exam	Students	End of the Course	60	24	Theory Answer Sheets	1, 2, 3
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Rubrics & Assessment Sheets	4,5,6
		Journal Writing		Continuous	05	--	Journal	4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Rubrics & Practical Answer Sheets	4,5,6
Indirect	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, writing observation table , draw waveforms and writing procedure etc.	10
2	Performance of the practical	20
3	Taking observations ,Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	3	3
3	3	-	-	-	-	-	-	-	-
4	3	-	-	3	-	-	-	3	3
5	3	-	-	3	-	-	2	3	3
6	3	-	-	3	-	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Wireless Communication	Theodore S. Rappaport, Prentice Hall Of india, 5 th Edition 2011	9788131731864
2	Mobile Cellular Telecommunication	William C. Y. Lee, Tata McGraw Hill, 2 nd Edition 2006	9780070635999
3	Wireless Communication	Andreas Molisch, Wiley, Student 2 nd edition	9780470741863
4	Mobile and Personal Communication System and Services	Raj Pandya, Prentice hall	9780780347083

❖ **E-REFERENCES:**

- <https://www.youtube.com/watch?v=exxj8S-tPgs> accessed on 27th January 2022
- <https://nptel.ac.in/courses/108/106/106106167/> accessed on 27th January 2022
- <https://www.youtube.com/watch?v=98OGDsot3dM> accessed on 27th January 2022
- <https://www.youtube.com/watch?v=d7zeaz-NjmM> accessed on 27th January 2022
- <https://www.youtube.com/watch?v=QHDxbbc1GWs> accessed on 27th January 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

1. GSM Mobile Unit
2. Digital Multi-meter
3. Cathode Ray Oscilloscope (0-50 MHZ)
4. Function Generator

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Mrs. U. P. Potdar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. D. N. Bhange	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip V. Darwhekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

 (Member Secretary PBOS)

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GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC303G ^{\$}
COURSE TITLE	: EMBEDDED SYSTEMS ^{\$}
TEACHING SCHEME	: TH:03; TU: 00;PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ **RATIONALE:**

As the digital world is growing rapidly in different application areas such as industrial/home automation, medical industry, entertainment industry etc, core of all these systems is Electronics Hardware and its associated software. By imparting knowledge of related technology and by providing hands on skills, students can develop and maintain Electronics Hardware based Embedded systems using open source platform. Thus this course is an important course for students aspiring to work with the Emerging Automation sector of Industries.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Use 'Embedded C' programming language for various embedded systems.
2. Select the relevant microcontroller for various Embedded System applications.
3. Use open source platform for developing basic applications of embedded system.
4. Interface various input output devices with the microcontroller using embedded c programming language.
5. Interpret the communication standards and protocols for various embedded systems.
6. Interpret features of Real Time Operating System.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Overview of Embedded System	1a. Differentiate between Embedded and General computing system on the basis of given criteria 1b. Classify embedded systems based on given criteria. 1c. Identify different purposes of various Embedded system applications. 1d. Select relevant processor for Embedded System 1e. Develop a program in Embedded C by 1f. Interpreting the difference between different Programming languages.	1.1 Definition of embedded system, Block diagram of the components of embedded system hardware, Difference between Embedded Systems and General computing systems. 1.2 Classification of embedded systems: Based on Generations, Complexity and Performance requirements, Deterministic behavior, Triggering 1.3 Purpose of embedded systems: Data collection/Storage/Representation, Data communication, Data processing, Monitoring and control, Application specific user interface, Applications of embedded Systems. 1.4 Processor embedded into a system : Microprocessor, Microcontroller, ARM, RISC, CISC, SoC, Digital Signal Processor 1.5 Overview of Programming Languages: C language, Embedded C, Assembly	08
2. Advance Microcontrollers	2a. Differentiate given micro controllers used for embedded system designing based on given criteria. 2b. Configure ATmega8 for interfacing given peripheral circuits with it. 2c. Develop a program for given microcontroller using various programming instructions.	2.1 Features of 89C51, PIC, AVR, ARM Microcontrollers with their applications. AVR microcontrollers: Types ,Architecture. Comparison between 89C51,PIC,AVR,ARM 2.2 Internal Architectural Block diagram of controller (Atmega8/Atmega328), Functions of each pins of ATmega8, Configuration of Two 8-bit and One 16- bit Timers and Counters, 6-channel ADC Working, Essential Peripheral circuits: Crystal Circuit, Power supply, Oscillator Circuit 2.3 Initial programming configurations of Atmega8/ Atmega328 in C: Branch, Call, and Time Delay , Loop , Arithmetic, Logic , I/O port, counter, timer, interrupt , Boot loader Circuit, ISP of ATmega8/ Atmega328	08

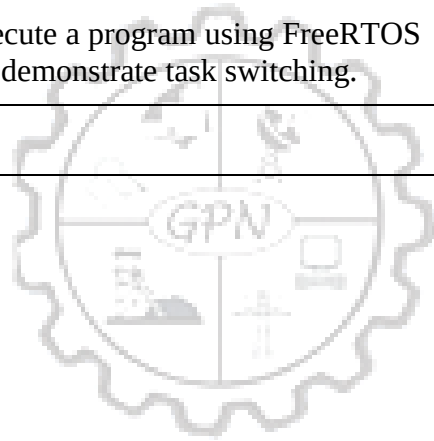
3. Open Source Embedded System Development Board (Arduino)	3a. Interpret working of various blocks on the open source embedded system development board. 3b. Develop a sketch for a given application using various instructions for Open Source Embedded system Development Board.	3.1 Arduino : Introduction to Open Source Prototype Platform, Features, Types of Arduino Boards, Components of Arduino Board, Functions of each Pin of Arduino 3.2 Steps for setting up Arduino IDE Programming of an Arduino: Designing of first sketch, I/O Functions, Looping Techniques, Decision Making Techniques, Arduino Boot loader	08
4. Interfacing of Input and Output Devices	4a. Develop program for interfacing given input/output device to the given microcontroller using Embedded C programming Language	4.1 Basic Steps for interfacing Input /Output devices with the Microcontroller, Interfacing of following Devices with the ATMEGA8/ATMEGA328 microcontroller using Embedded C programming Language: • LED, • LCD, • Relays, • 7- Segment Displays, • Matrix keyboard, • ADC & DAC, • Stepper Motor, • DC motor , • Temperature Sensor	08
5. Communication standards & Protocols	5a. Describe the given modes of data communication. 5b. Analyze the protocols used for given applications.	5.1 Need of communication interface in embedded system. Modes of data communication : Serial, Parallel, Synchronous, Asynchronous communication 5.2 Serial Communication Standards: RS-232, Serial communication protocols (I2C, SPI, CAN) , Features of Advanced Serial communication protocols : (MODBUS, IrDA, Bluetooth) Parallel Communication Protocols: PCI,PCIX	08
6. Real Time Operating System	6a. Classify given types of operating Systems. 6b. Describe given Functions of RTOS. 6c. Analyze the need for task synchronization in a multitasking environment. 6d. Develop FreeRTOS	6.1 Basics of an Operating Systems, Types of Operating systems: GPOS,RTOS(Hard Real Time and Soft Real Time) 6.2 Concepts of Task, Process, Threads. Functions of RTOS: Multiprocessing, Multitasking, Task, Scheduling (Scheduling Algorithms), Task communication	08

	based Arduino sketch to demonstrate real time task execution	(Resource allocation), Interrupt handling 6.3 Task synchronization : Reason for occurrence of Deadlock, Handling, Detection, prevention and ignoring of Deadlock 6.4 FreeRTOS : Introduction, Designing of FreeRTOS based Arduino first sketch	
		Total Hrs.	48

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Organize given embedded system based on following points – - Block Diagram - Classification - Purpose - Processor used OR Develop and Execute an Embedded C program for LED blinking using 8051 microcontroller	Overview of Embedded System	02
2	Identify each block of ATmega8 with Pins.	Advance Microcontrollers	02
3	Identify the features and specifications of Arduino development board.	Open Source Embedded System Development Board (Arduino)	02
4	Install Arduino IDE tool.		02
5	Develop and execute Embedded C language program to blink a LED connected on port pin of Atmega8		02
6	Develop and execute C language program to generate square wave on port pin of Atmega8.		02
7	Develop and execute C language program to read the status of key from port pin and turn ON/OFF a LED connected to another port of Atmega8.	Interfacing of Input and Output Devices	02
8	Interface 7 segment display to Atmega8. Develop and execute C language program to Display digits 0 to F on it.		02
9	Interface 16 x 2 LCD to Atmega8. Develop and execute C language program to display string “G P Nagpur” on it.		02
10	Interface a 4 x 4 matrix keyboard and 16 x 2 LCD to Atmega8. Develop and execute C		02

	language program to read and display key code on LCD.		
11	Interface POT and 16 x 2 LCD to Atmega8. Develop and execute C language program to read and display data of ADC on LCD.		02
12	Interface 8 bit DAC to Atmega8. Develop and execute C language program to generate triangular waveforms.		02
13	Interface stepper motor to Atmega8. Develop and execute C language program to rotate stepper motor with different speed in clockwise and counter clockwise direction.		02
14	Interface DC motor to Atmega8. Develop and execute C language program to rotate DC motor with different speed in clockwise and counter clockwise direction.		02
15	Read Temperatures using I2C, TC04 temperature sensors and Arduino	Communication standards & Protocols	02
16	Develop and execute a program using FreeRTOS with Arduino to demonstrate task switching.	Real Time Operating System	02
Total Hrs			32



❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Overview of Embedded System	02(02)	03(03)	06(00)	11(05)
2	Advance Microcontrollers	02(02)	06(03)	03(00)	11(05)
3	Communication standards & Protocols	02(02)	03(03)	03(03)	8(08)
4	Open Source Embedded sytem Development Board (Arduino)	02(00)	06(03)	03(03)	11(06)
5	Interfacing of Input and Output Devices	02(00)	03(03)	06(00)	11(03)
6	Real Time Operating System	02(00)	00(03)	06(06)	8(09)
	Total	12(06)	21 (18)	27(12)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	1	R	2	2	R	2	3	R	2										
2	1	U	3	2	U	3	3	U	3	1	U	3	3	U	3				3/5
3	2	U	3	4	U	3	5	U	3	2	U	3	6	U	3				3/5
4	4	U	3	2	A	3	3	A	3	4	U	3	5	U	3				3/5
5	4	A	3	1	A	3	1	A	3	4	A	3	3	A	3				3/5
6	5	A	6	6	A	6	6	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	3	-	-
2	3	3	3	-	-	3	3	-	-
3	3	-	-	3	-	-	3	-	-
4	3	-	3	-	-	3	3	1	1
5	3	-	-	-	1	-	3	-	-
6	3	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Embedded System Design A Unified Hardware / Software Introduction	Frank Vahid & Tony Givargis, Wiley India Pvt. Ltd., Student Edition 2006	978-0-471-38678-0
2	Embedded System Architecture, Programming and Design	Raj Kamal, Tata McGraw-Hill Education, 2 nd Edition 2011	978-0-070-66764-8
3	The Atmega8 Microcontroller and Embedded System Using Assembly and C	Mazidi, Mazidi, McKinlay, PHI, 1 st Edition, 2010	978-81-317-1026-5
4	Micro C/OS-II The Real Time Kernel	Jean J Labrosse, CMP books U.S.A., 2 nd Edition 2002	978-157820-103-7
5	Embedded/Real-Time Systems: Concept, Design & Programming	Dr K.V.K.K. Prasad, Dreamtech Press, 1 st Edition 2003	978-8177224610
6	Microcontrollers (Theory and Applications)	Ajay V. Deshmukh, Tata McGraw-Hill Education, 2005	978-0070585959

7	The AVR microcontroller and embedded system using assembly and c	Muhammad Ali Mazldl, SarmadNaimi, Prentice Hall, 2011	978-0-13-800331-9
8	Exploring Arduino: Tools and Techniques for Engineering Wizardry	Jeremy Blum, Wiley, 2013	978-1-118-54936-0
9	Beginning Arduino	Michael McRoberts, Apress, 2 nd Edition 2013	978-1430250166
10	Beginning Arduino Programming	Brian Evans, Apress, 1 st Edition 2011	978-1430237778

❖ E-REFERENCES:

- <https://www.cse.iitb.ac.in/~cs330/emb-lect.pdf>, accessed on 16th August 2021
- <http://nptel.ac.in/courses/108102045>, accessed on 16th August 2021
- <http://nptel.ac.in/courses/108105057>, accessed on 16th August 2021
- http://www.slideshare.net/murugan_m1/embedded-system-basics?qid=e84c592d-722d-43b6-8ae8-c58dfc2dbc5a&v=&b=&from_search=1, accessed on 17th August 2021
- pet.ece.iisc.ernet.in/course/E2223/Cha1.pdf, accessed on 17th August 2021
- <http://www.engineersgarage.com/articles/rtos-real-time-operating-system>, accessed on 18th August 2021
- <http://arduino.cc>, accessed on 19th September 2021
- <http://www.instructables.com/id/Arduino-Projects>, accessed on 19th September 2021

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:

1. Embedded development board (Arduino Board) – 20 Nos.
2. Open Source IDE for embedded systems (Arduino)
3. Computer System - 20 Nos.
4. Consumable as needed in application suggested by concern Faculty.

❖ LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Ms. A. S. Aghav	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. J. P. Kelwade	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. S. V. Darwhekar	Director, Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics	Anjuman Polytechnic,

		Engineering	Nagpur.
7	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

**PROGRAMME : DIPLOMA IN ELECTRONICS AND
TELECOMMUNICATION ENGINEERING**

COURSE CATEGORY: PROGRAMME CORE COURSE

COURSE CODE : EC304G

COURSE TITLE : CONSUMER ELECTRONICS

TEACHING SCHEME: TH:04; TU:00; PR:02(CLOCK Hrs.)

TOTAL CREDITS : 05 (1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT = 2 CLOCK HR.)

TH. TEE : 03 HRs

PR. TEE : 02 HRs

PT. : 01 HR

❖ RATIONALE:

The objective of this course is to give in-depth knowledge of various electronic audio and video devices and systems. This course will introduce the working principles, block diagram, main features of consumer electronic gadgets/devices. This course includes the working principles of consumer electronic appliances to develop troubleshooting skill in systematic way. This course would also help in production units of these consumer gadgets or help the students to start their own enterprises.

❖ COURSE OUTCOMES:

1. Troubleshoot various types of microphones and loud speakers in audio system.
2. Analyse and describe the various basic terms in audio systems.
3. Classify the various types of colour TV standards and system.
4. Analyse the various digital and analog signal used in TV transmitter and receiver.
5. Exhibit various safety standards in consumer electronics appliances.
6. Demonstrate the operation of different types of consumer electronics appliances.

❖ **COURSE DETAILS:****A. THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs
1. Audio Fundamentals	1a. Analyse various characteristics of sound signal. 1b. Differentiate mono and stereo amplifier on given points. 1c. State operating principle of given microphone. 1d. Select the microphone and speaker for the given application. 1e. Describe with sketches the working of the given type of speaker. 1f. Describe the troubleshooting of speakers.	1.1 Basic characteristics of sound signal: Level and loudness, pitch, frequency response, sensitivity and selectivity. 1.2 Audio amplifiers: Mono and Stereotype. 1.3 Microphone: working principle and Characteristics, Types: carbon, condenser, crystal, electrets and tie clip. 1.4 Speakers: working principle and Characteristics, Types: electrostatic, dynamic, permanent magnet, 1.5 Woofers, tweeter and mid-range, Wireless. 1.6 Troubleshooting procedure of speakers.	10
2. Audio Systems	2a. Analyze functions of different sections use in CD player. 2b. Describe fidelity & Hi-fi. 2c. State the need of high fidelity requirement in Hi-Fi system. 2d. Analyse curves of multi way speaker system. 2e. State the need of Public Address System 2f. Construct block diagram of Hi-Fi stereo reproducing system . 2g. State necessity of PA system. 2h. Describe the trouble shooting procedure of given section of audio system.	2.1 Block diagram of CD player and its types. Component used for CD mechanism: CD pickup assembly, Gear system, drive motors, CD lens. 2.2 Hi-Fi system, Definition of Fidelity, High Fidelity 2.3 Requirements of Hi-Fi systems. 2.4 Block diagram of Hi-Fi stereo reproducing system various causes affecting fidelity. 2.5 Multiway speaker system, Crossover networks –Basic circuits and response curves of two way and three-way speaker system. 2.6 Public Address System block diagram, Need, Requirements and applications of PA system. 2.7 PA system for public meeting, large capacity auditorium. 2.8 Block Diagram and working of Audio Mixer.	10
3. TV Fundamentals	3a. State various terms related to basics of TV. 3b. Describe the concept of scanning methods. 3c. Identify various terms of scanning, resolution, composite	3.1 Introduction of TV, Aspect ratio and flicker. 3.2 Scanning: Need of scanning, Saw tooth currents for scanning, Progressive scanning, Interlaced scanning, Frame, Field and line frequencies. 3.3 Resolution: Vertical resolution,	12

	video signal. 3d. Describe waveforms of Composite Video Signal & its various parts. 3e. Describe the concept of Positive & negative modulation. 3f. State advantages & disadvantages of Positive & negative modulation. 3g. State types of TV standards, CCIRB standards. 3h. Describe functions of different block in monochrome TV transmitter & receiver. 3i. Describe the working principle of TV camera. 3j. State advantages and disadvantages of TV camera.	Horizontal resolution, Bandwidth of video signal. 3.4 Composite Video Signal: Synchronization and blanking, Positive & Negative polarities of CVS, Voltage levels in CVS with waveform. 3.5 Horizontal Blanking pulse, Horizontal sync pulse details. 3.6 Vertical Blanking pulse. Vertical sync pulse details-Serration's pre-equalizing, post-equalizing pulses. 3.7 Modulation requirements for TV positive & negative modulation, advantages & disadvantages of Negative modulation. 3.8 Need of television standards, Types of TV standards, CC IR B standards. 3.9 Basic block diagram of monochrome TV transmitter & receiver. 3.10 TV Camera: Solid State camera based on CCD, Advantages of Solid-State TV camera.	
4. Colour TV Systems	4a. State and define various terms use to describe colour & colour theory. 4b. Describe basic Block diagram of colour TV transmitter & receiver. 4c. Illustrate the working principle of colour TV transmitter & receiver. 4d. State the concept of Compatibility of colour and B/W TV. 4e. Draw the block diagram of Generation of luminance (Y) & chrominance signal (U & V). 4f. Describe with sketches the function of the given section of colour TV receiver. 4g. Describe with sketches the PAL-D decoder.	4.1 Characteristics of colour : Hue, Saturation, Luminance, Resolution & bandwidth of colour. 4.2 Colour theory : primary & complementary colour , additive & subtractive Colour mixing, Grassman's law. Compatibility of colour and monochrome TV signal. 4.3 Colour TV camera: Generation of luminance & chrominance signal, Transmission of colour difference signal, Weighing factors for colour difference signal. 4.4 Block diagram and Operation of color TV transmitter. and PAL-D encoder. HDTV: Development of HDTV, NHK, MUSE system and NHK. 4.5 Principle and working of LCD TV Block diagram and Operation of color TV Receiver. 4.6 Troubleshooting procedure of Colour TV Receiver systems. 4.7 Block diagram and working of PAL D decoder.	12

5. Office Gadgets	5a. State need of DTH and analyse each section in DTH receiver 5b. Describe concept of DTH. 5c. Describe block diagram of personal computer. 5d. Illustrate stepwise procedure for installation of printer. 5e. State Limitation & applications of printer. 5f. Illustrate safety standards for scanner, printer and EPABX.	5.1 Direct to Home Receiver (DTH): Concept, receiver block diagram, Indoor and outdoor unit. 5.2 Personal Computer Components in the central unit. Computer peripherals. 5.3 Printer Types. Block Diagram, Components of printer, Working Principal, Installation Procedure 5.4 Scanner-Block Diagram, Components of Scanner, Working Principal Installation Procedure. 5.5 EPABX- Block Diagram, Components of EPABX, Working Principal 5.6 Safety standards for printer, scanner and EPABX system.	10
6. Consumer Electronic Appliances	6a. Describe the working of the given section of the photocopier machine with its specifications. 6b. Prepare specification of a Microwave oven for the specific applications. 6c. Describe working of the given section of the given type of washing machine. 6d. Clarify with sketches the working of the given type of Digital camera. 6e. Illustrate the troubleshooting procedure of the given office/home appliances.	6.1 Photocopier block diagram, and its working. 6.2 Microwave Oven: types, single chip controllers, block diagram, types, and safety instructions, electrical specifications. 6.3 Washing Machine: Block diagram of washing machine, electrical. Specifications, types of washing machine: Automatic, semi-automatic. 6.4 Digital camera and cam-coder: pickup devices, picture processing, and picture storage electrical specifications. 6.5 Air conditioner and Refrigerators: Basic block diagram, Components, features, applications, and technical specification.	10
Total Hrs.			64

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs .
1	Measuring audio intensity level of various sounds with the help of suitable audio level meter.	1. Audio Fundamentals	02
2	Check the audio frequency range of various sounds by connecting signal generator /mike on input side and loudspeaker/ CRO/ DSO on output side.		02
3	Test various functions of Hi Fi amplifier system with suitable mike and speakers.	2. Audio system	02
4	Test the performance of graphic equalizer/ cross over		02

	network by plotting its frequency response.		
5	Collect information & compare performance parameters of various audio systems & their components like special microphones/Headphones/SpeakerBaffles&Enclosures /Multi-speakersystems/Stereo systems/Equalizers &mixers/ PA system/ Surround sound system/Synthesizer (at least three brands) and Prepare report (make groups of 4 or 5 students).		02
6	Generate composite video signal by using colour TV pattern generator and measure its dimensions.	3.TV Fundamentals	02
7	Test various functions & explore various settings of colour TV /colour TV remote control unit/ digital TV.		02
8	Trace video IF/chroma/ vertical / horizontal / sound sections/ video output/power supply sections of given colour TV.	4.Colour TV systems	02
9	Test given colour TV receiver for various faults in video IF/chroma/ vertical / horizontal / sound / video output/power supply sections of given colour TV supply section etc .		02
10	Collect information & compare performance parameters of various Video systems like colour TV /Digital TV/ LED TV/ HDTV/DTH/TFT monitor/ DLP projector/(at least three brands) and Prepare report . (make groups of 4 or 5 students)		02
11	Verify connections and Internal functions of Printers/ Explore functions of scanner settings.	5. Office Gadgets	04
12	Verify the performance of Refrigerators. Compare performance parameters of at least three brands/ Explore the various functions of automatic washing machine and locate various sensors used in that washing machines.		04
13	Explore the various functions of AC and locate various sensors used in AC unit.	6.Consumer Electronic Appliances	04
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

T.N.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Audio Fundamentals	02(00)	03(03)	00(00)	05(03)
2	Audio system	02(02)	03(03)	06(00)	11(05)
3	TV Fundamentals	02(00)	03(03)	06(06)	11(09)
4	Colour TV systems	02(02)	06(03)	03(03)	11(08)
5	Office Gadgets	02(00)	06(03)	03(03)	11(06)
6	Consumer Electronic Appliances	02(02)	03(03)	06(00)	11(05)
		12(06)	24(18)	24(12)	60(36)

R – Remember

U – Understand

A – Analyze / Application

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	4	R	2	6	R	2										
2	1	U	3	2	U	3	3	U	3	1	U	3	2	U	3				3/5
3	4	U	3	4	U	3	5	U	3	3	U	3	4	U	3				3/5
4	5	U	3	6	U	3	4	A	3	5	U	3	6	U	3				3/5
5	5	A	3	6	A	3	6	A	3	4	A	3	5	A	3				3/5
6	2	A	6	3	A	6	3	A	6										2/3

T -Unit/Topic Number
R-RememberL- Level of Question
U-UnderstandM- Marks
A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous)	Progressive Test (PT)	Students	Two PT (average of two tests)	25	--	Test Answer Sheets	1, 2, 3,5.6
		Assignments		Continuous	15	--	Assignment Book / Sheet	1, 2, 3,5.6
	TEE	End Exam	Students	End of the Course	60	24	Theory Answer Sheets	1, 2, 3,5.6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous assessment of Practical	Students	End of Practical	20	--	Rubrics &Assessment Sheets	1, 2, 3,5.6
		Journal Writing		Continuous	05	--	Journal	1, 2, 3,5.6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Rubrics & Practical Answer Sheets	1, 2, 3,5.6
Indirect	Student Feedback on course		Students	After First Progressive Test	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course			End of the Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit block diagram, selection of equipments. writing procedure etc.	20
2	Performance	10
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	3	-	3	-	-		-	3
2	3		-	3	-	1		3	-
3	3		-	-	3	-		-	-
4	3	3	-	-	-	-		-	3
5	3		-	3	3	2		3	3
6	3	3	-	3	3	2	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Audio And Video Systems	R.G Gupta, Tata McGraw-Hill Second Edition, Fifth reprint 2012	0070699763, 9780070699762
2	Television Engineering and Video systems	R.G Gupta, Tata McGraw-Hill Second Edition, Third reprint 2012	0071077812, 9780071077811
3	Consumer Electronics	S.P. Bali ,Pearson Education, Second Impression ,2009	9788131717592
4	Modern TV Practice	R.R Gulati New age International Pvt. Ltd, Fifth Edition,2015	978-81-224-3784-3

5	Audio And Video Systems	S.P. Bali ,Rajeev Bali ,Khanna books publishing , First Edition, 1999	8187522054
6	Television & Video Engineering	A.M Dhake Tata McGraw-Hill, Second Edition,1999	0074601059.
7	Mastering Digital Television	Whitaker Jerry & Benson Blair	978-0071470162

❖ **E-REFERENCES:**

- <http://electronics.howstuffworks.com/analog-digital3.html> accessed on 20th January , 2022
- <http://electronics.howstuffworks.com/dtv.html> accessed on 19th January ,2022
- <http://electronics.howstuffworks.com/tv10.html> accessed on 20th January ,2022
- <http://electronics.howstuffworks.com/dvd.html> accessed on 22th January ,2022
- <http://electronics.howstuffworks.com/high-fidelity-high-definition.html> accessed on 20th January , 2022
- <http://nptel.ac.in/courses/106105082/38> accessed on 20th January ,2022
- <https://www.explainthatstuff.com/washingmachine.html> accessed on 20th January , 2022

❖ **LIST OF MAJOR EQUIPMENTS/ INSTRUMENTS WITH SPECIFICATION:**

1. Ammeter MI 0-5-10A
2. Voltmeter MI 0-150-300V
3. Digital Multi-meter
4. Cathode ray oscilloscope- 0 to 50MHz
5. Function Generator
6. Digital Camera, OLED TV
7. Regulated Power Supply
8. Microwave Oven, Washing Machine.

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Mr. Sachin M. Kale	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mrs. U. M. Ramteke	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip Darvekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS & TELECOMMUNICATUION ENGINEERING
COURSE CATEGORY	: PROGRAMME ELECTIVE COURSE
COURSE CODE	: EC305G
COURSE TITLE	: POWER ELECTRONICS
TEACHING SCHEME	: TH: 03; TU: 00; PR: 02(CLOCK HRs.)
TOTAL CREDITS	: 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: 03 HRs
PR. TEE EXAM	: 02 HRs
PT. EXAM	: 01 HR

❖ **RATIONALE:**

The objective of this course is to introduce power electronic devices and their applications in electronic systems that are utilized by the industries. This course describes the fact, symbolic representation, principle of working of these devices, so that students can use knowledge in acquiring supervisory skills and prototype testing skills.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Analyze the characteristics of power electronic devices.
2. Use different methods for triggering & commutation of SCR.
3. Test the performance of controlled rectifier with different load.
4. Use inverters in different applications.
5. Measure the output voltage of chopper for different values of duty cycle.
6. Use suitable power electronic device in the given industrial circuit.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
1.Power Electronics Devices.	1a. Implement the operating principle of SCR using two transistor analogy 1b. Analyze the V-I characteristics of given power electronics device(s). 1c. Describe a given triggering device(s) with construction, operating principle, V-I characteristics & applications	1.1 SCR: Symbol, Construction, Operating principle with Two transistor analogy, V-I Characteristics, applications of SCR. 1.2 Thyristor family devices: LASCR, SCS, GTO, TRIAC, Power transistor, Power MOSFET & IGBT: Symbol, construction, operating principle, V-I Characteristics & applications. 1.3 Triggering devices- UJT, PUT, and DIAC: Construction, operating Principle, V-I characteristics and applications.	10
2. Triggering & Commutation Methods of SCR	2a. Use different triggering methods to turn on the SCR 2b. Classify turn off methods of SCR. 2c. Use different protection circuits to protect SCR against particular condition.	2.1 Triggering of SCR.: Concept SCR Turn ON Methods- Thermal triggering, Light triggering, Forward voltage triggering, Gate Current triggering, dv/dt triggering, R-triggering, RC-triggering, UJT-relaxation oscillator, synchronized UJT triggering: Circuit diagram, Working principle with waveforms 2.2 SCR Turn OFF Methods (Commutation): Basic classification. Class A, Class B and Class C commutation methods: circuit diagram & working. 2.3 SCR Protection circuits: over voltage, over current, di/dt, dv/dt, snubber circuit, crowbar	09
3. Phase Controlled Converters	3a. Classify the different types of controlled rectifiers. 3b. Interpret the output waveforms of the given phase-controlled rectifier for given load condition 3c. Use bridge configuration for phase-controlled rectifier. 3d. Describe given three phase controlled rectifier with given load	3.1 Concept of Phase angle control: Firing angle (α) and conduction angle ($\emptyset$). Types of Controlled rectifiers. Difference between controlled and uncontrolled rectifiers. 3.2 Single phase-controlled rectifier Single phase half wave-controlled rectifier: circuit diagram, working and waveforms with R and R_L load, effect of freewheeling diode with R_L load and related waveforms.	10

		Single phase centre tapped full wave controlled rectifier: circuit diagram, working and waveforms with R and R_L load, effect of freewheeling diode with R_L load and related waveforms 3.3 Bridge configuration (Half and fully) circuit diagram, working and waveforms with R load 3.4 Three phase half wave controlled rectifier with R-load.	
4. Inverters	4a. Demonstrate the limitation of basic series inverter with relevant waveforms. 4b. Compare improved series inverter with basic series inverter on given points 4c. Differentiate between series and parallel inverter with respect to given points.	4.1 Need of inverter and its Classification, Basic series inverter using SCR: circuit diagram, working and related waveforms. Merits, demerits and applications of series inverter. 4.2 Improved series inverter: circuit diagram, working and related waveforms, merits of improved series inverter. 4.3 Basic parallel inverter using SCR with Resistive and feedback diode: circuit diagram, working and related waveforms. Merits, demerits and applications of parallel inverter.	07
5. Choppers	5a. Construct & discuss the working of basic chopper circuit. 5b. Describe given chopper with its block diagram, working and relevant waveforms.	5.1 Definition of chopper, need of chopper, Basic chopper circuit: circuit diagram, principle of working. 5.2 Classification of Chopper: - Step down chopper using power MOSFET: block diagram, working and related waveforms. Basics of Control Strategies. - Step up chopper using power MOSFET: block diagram, working and related waveforms - Morgan and Jones chopper: circuit diagram, working and related waveforms, 2–Quadrant and 4–Quadrant choppers, voltage and current commutated choppers - Applications of chopper.	06
6. Industrial applications of power electronics devices.	6a. Troubleshoot & use suitable power electronic device in the given industrial circuit. 6b. Compare online UPS with offline UPS on given points.	6.1 Power Electronic Applications: - Fan regulator/Light dimmer circuit using DIAC-TRIAC - Battery charger using SCR - Emergency lighting system using SCR - Light operated SCR alarm	06

	6c. Differentiate between UPS and SMPS with respect to given points	circuit Smoke detector using SCR 6.2 UPS (Uninterrupted Power Supply) : block diagram and working (on line and off line) 6.3 SMPS (Switched Mode Power Supply): block diagram and Working	
Total Hrs.			48

B. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Accumulate the specification of different power electronics devices from the data sheet and prepare a report for them.	Power Electronics Devices	4
2	Measure holding current (I_H), latching current (I_L) & forward break over voltage of a given SCR from its V-I characteristic curve.		4
3	Measure break over voltage of given DIAC from its V-I characteristic curve.		2
4	Measure forward/reverse output current for various forward/reverse voltage and plot V-I characteristics of TRIAC.		2
5	Find the value of on state voltage of a given IGBT from its V-I characteristic curve		2
6	Analyze the effect of variation of R on firing angle in synchronized UJT triggering circuit.	Triggering methods of SCR	2
7	Measure the average output voltage & test the performance of single-phase half wave-controlled rectifier with R, RL load	Phase Controlled Converters	2
8	Measure the average output voltage & test the performance of single-phase full wave-controlled rectifier with R, RL load		2
9	Measure the value of load voltage of series inverter circuit and plot the waveforms.	Inverters	2
10	Find the output voltage of step-up chopper for different values of duty cycles and plot the waveforms.	Choppers	2
11	Build Light dimmer circuit using TRIAC and observe its functioning.	Industrial applications of power electronics devices.	4
12	Mini project: Design power electronics circuit using power electronics devices. - Test its functioning. - Prepare report.		4
Total Hrs			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Power Electronics Devices.	02(00)	06(03)	06(03)	14(06)
02	Triggering & Commutation Methods of SCR	02(02)	03(03)	03(00)	08(05)
03	Phase Controlled Converters	02(00)	06(03)	06(06)	14(09)
04	Inverters	02(02)	03(00)	03(03)	08(05)
05	Choppers	02(02)	03(03)	03(00)	08(05)
06	Industrial applications of power electronics devices.	02(00)	03(03)	03(03)	08(06)
	Total	12(06)	24(15)	24 (15)	60 (36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER

T= Unit/Topic Number

L= Level of Question

M= Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
01	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	4	R	2	5	R	2										
02	1	U	3	2	U	3	3	U	3	1	U	3	2	U	3				3/5
03	4	U	3	5	U	3	6	U	3	3	U	3	5	U	3				3/5
04	1	U	3	3	U	3	2	A	3	6	U	3	1	A	3				3/5
05	4	A	3	5	A	3	6	A	3	4	A	3	6	A	3				3/5
06	1	A	6	3	A	6	3	A	6										2/3

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End Of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End Of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs (if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	-	-	-	-	-	3	3	-
2	3	-	3	3	-	-	3	3	-
3	3	-	3	3	3	3	3	3	3
4	3	-	3	3	3	3	3	3	3
5	3	-	3	3	3	3	3	3	3
6	3	-	3	3	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1.	An Introduction to Thyristors And Their Applications.	M. Ramamoorthy East-West Press Pvt. Ltd. 2nd Edition	9780333256947
2.	Power Electronics	M.D Singh, K. B. Khanchandani Tata McGraw Hill. - 2 nd Edition, 1998	13:9780070583894
3.	Industrial and Power Electronics	G.K. Mithal, Khanna Publishers Edition:	13: 9788174091093
4.	Thyristors-Theory and Applications	Sugandhi KK, Sugandhi RK Wiley, 1981	9780470271346
5.	Industrial and Power Electronics	Harish C. Rai, Umesh Publications. 5 th Edition, 1994	10:8175150459
6.	Power Electronics : Devices, Converters, Application	Vedam Subrahmanyam Publication 2nd Edition-1987	9788122417470
7.	Industrial Electronics and Controls	S K Bhattacharya McGraw Hill Publishing Co. Ltd, New Delhi	0074624776
8.	Power Electronics Circuits Devices and Applications	Rashid, Muhammad H. Pearson Education India, New Delhi. 2012	9780133125100

❖ **E-REFERENCES:**

- www.nptel.ac.in/courses/108101038, accessed on 25th January 2022
- www.worldcat.org/title/introduction-to-thyristors-and... accessed on 25th January 2022.
- www.en.wikibooks.org/wiki/Power_Electronics, accessed on 25th January 2022
- www.books.google.co.in/books/about/Power_Electronics, accessed on 25th January 2022
- www.youtube.com/watch?v=1Auay7ja2oY, accessed on 25th January 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION**

1. Digital Multi-meter 3.5 digit with R, V, I measurements, diode and BJT testing
2. Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz
3. Function Generator 1 MHz, sine, square, triangular, ramp and pulse generator
Frequency range 0.01 Hz to 1 MHz, Output amplitude 20V open circuited,
Output impedance 50 ohms.
4. Regulated Power Supply 0- 30 Volt, 2 A with digital display

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1.	Dr. R.V.Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2.	Dr. V.H.Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3.	Dr. D. N. Bhange	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4.	Dr. M.N.Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5.	Mr.Sandip V. Darwhekar	Director, Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6.	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7.	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)



GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS & TELECOMM. ENGG.
COURSE CATEGORY: PROGRAMME ELECTIVE COURSE
COURSE CODE : EC306G
COURSE TITLE : CONTROL SYSTEMS
TEACHING SCHEME: TH:03; TU: 00;PR: 02(CLOCK HRs.)
TOTAL CREDITS : 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM : 03 HRs
PR. TEE EXAM : 02 HRs
PT. EXAM : 01 HR

❖ RATIONALE:

The development of technology has seen a wide use of automatic control system to improve the quantity and quality of manufactured products in many domestic, industrial and defense applications. Now a days it is very much essential to complete the required work or task automatically in every field, to increase the effectiveness, efficiency and quality of products, As the control system is the basis of various automatic control systems, therefore the students of electronic engineering must have the knowledge of different control systems.

❖ COURSE OUTCOMES:

After completing this course students will be able to–

1. Identify the type of control systems.
2. Analyze the control system for different input signals.
3. Select appropriate Control system components for control actions
4. Determine the stability of the system using Routh criteria
5. Interpret root locus for stability of the system.
6. Use relevant control action for controlling the processes

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Introduction of Control System	1a. Analyse given control system. 1b. Compare control systems on given points 1c. Develop differential equations for given electric circuits 1d. Determine transfer function of given system using block diagram reduction techniques.	1.1 Definitions of control system. Block diagram of control system Classification of control systems. 1.2 Definition, block diagram, practical example and Comparison of open loop & closed loop control system. Advantages, disadvantages of Open loop and Closed loop control systems. 1.3 Laplace transform – Significance in control system, developing differential equations of R-C and R-L-C electric circuits 1.4 Transfer function of Open loop control system and closed loop control system. Derivation of transfer function for close loop control system. Block diagram reduction techniques Reduction rules, problems (only SISO)	10
2. Time Domain Analysis	2a. Plot given standard test signal. 2b. Analyse the time response of given system. 2c. Plot the poles and zeroes for the given system. 2d. Compare types of systems on given points.	2.1 Introduction of time domain analysis. Transient and steady state response Standard test signal: step, ramp, parabolic and impulse signal Mathematical representation and Laplace transform 2.2 Time response of first order system for step input. Time response of second order system for step input. Definition and formulas for Time response specification (No derivations) T_p , T_s , T_r , T_d , M_p , e_{ss} 2.3 Poles & zeros – definition, S plane representation 2.4 Types of feedback control system: type 0 system, type 1 system and type 2 system , Steady state error and error constants	10

3. Control System Components and Servo Systems	3a. Describe given servo components with their neat sketch. 3b. Compare given types of motors on given points. 3c. Analyse the working of given stepper motor.	3.1 Servo system – definition, block diagram, Servo components: • Potentiometer: Construction , working, Potentiometer as error detector • Synchro: Construction , working, Synchro as error detector • Rotary Encoder: Types , working, application 3.2 DC servo motor : Salient features, difference from a normal DC motor, Construction, characteristics and working of Armature controlled and field controlled DC servo motor AC servo motor: Salient features, construction, working, application 3.3 Stepper Motor: Salient features, construction, working of Variable reluctance and Permanent magnet stepper motor	08
4. Concept of Stability	4a. Analyse the stability of system from given plot. 4b. Determine the stability of system with given root locations. 4c. Determine stability of given system using Routh stability criterion 4d. Describe special cases of Routh stability criterion 4e. Find gain K for given system to be stable	4.1 Definition of stability. Necessary condition for stability. Types of stability (relative, absolute, conditional). 4.2 Characteristic equation for Stability 4.3 Root locations in S-plane for stable and unstable systems. 4.4 Routh stability criterion. Numericals based on Routh stability criterion 4.5 Conditions and Special cases for Routh stability criterion. 4.6 Application of the Routh stability criterion to linear feedback.	08
5. Root Locus Techniques	5a. State different rules to construct root locus. 5b. Describe the give construction rule of root locus. 5c. Sketch root locus for a given transfer function.	5.1 Introduction of the root locus concept, Construction of root loci. 5.2 Construction Rules Definition of Asymptotes, Centroid, Breakaway point, Angle of departure, Angle of arrival. 5.3 Numericals based on above topic	06
6. Control Actions & Process Controllers	6a. Describe the given block diagram of controller 6b. Select controller for given application. 6c. Analyse the working	6.1 Process control system: Block diagram, working 6.2 Control actions: Discontinuous mode On off controllers: neutral zone Continuous Mode Proportional controllers (offset, proportional	06

	of given controller. 6d. Analyse the working of given controller using op-amps.	band) Integral & derivative controllers Block diagram and output equations 6.3 Composite controllers: Block diagram , output equation, operation and response curve of PI, PD,PID controllers 6.4 Electronic controllers: Circuit diagram and equations of Op amp based PI,PD,PID controllers	
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Demonstrate the performance of closed loop control system using electronic amplifiers- Op Amps.	1. Introduction Of Control System	02
2	Connct RC circuit (first order system) to CRO and plot its step response .	2. Time Domain Analysis	02
3	Measure time response specifications ie T_p , T_s , T_r , T_d , M_p for second order system(RLC circuit) by plotting the time response.		04
4	Measure the steady state error of type 1/type 2 first order system		04
5	Plot the response of potentiometer as error detector	3. Control system Components and servo systems	02
6	Plot the variation in output position with respect to input position for synchro as error detector		04
7	Derive the open loop and closed loop poles and zeros for varieties of the systems. Draw their Pole-zero map and check the system stability.	4. Concept Of Stability	04
8	Determine the stability of given system using matlab / Scilab. (Routh stability Criterion)		02
9	Plot root locus for a given system using matlab / Scilab. Derive the value of gain from Root Locus for system marginal stability.	5. Root Locus Techniques	04
10	Demonstrate the temperature PID controller in closed	6. Control actions	04

	loop.	& process controllers	
Total Hrs			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction Of Control System	02(00)	03(06)	06(00)	11(06)
2	Time Domain Analysis	02(02)	03(03)	06(00)	11(05)
3	Servo Systems And Controllers	02(02)	06(00)	03(03)	11(05)
4	Concept Of Stability	02(00)	03(06)	06(00)	11(06)
5	Root Locus Techniques	02(02)	03(00)	03(06)	08(08)
6	Bode Plot Method	02(00)	06(00)	00(06)	08(06)
	Total	12(6)	24(15)	24(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:**

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

1 R 2 means Unit/Topic Number No- 1, Level of Question –Remember, Marks – 2 Marks

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Options
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	3	R	2	5	R	2										
2	1	U	3	2	U	3	3	U	3	1	U	3	2	U	3				3/5
3	3	U	3	5	U	3	2	A	3	1	U	3	2	A	3				3/5
4	4	U	3	2	A	3	3	A	3	4	U	3	4	U	3				3/5
5	6	U	3	5	A	3	6	U	3	6	A	3	6	A	3				3/5
6	1	A	6	4	A	6	5	A	6										2/3

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing circuit diagram, selection of equipment. writing procedure etc.	10
2	Performance	20
3	Calculation, Result, Drawing Graphs(if any)	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3						2	2	2
2	3	3					2	2	2
3	3		3		2	2	2	2	2
4	3	3	3	3		2	2		
5	3	3	3	3		2	2		
6	3		3	3	2	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Control System Engineering	I.J. Nagarath and M. Gopal 5 TH Edition , John Wiley and Sons, 2000	13: 978-1848290037
2	Control Systems	Naresh K. Sinha 4 th Edition New Age International (P) limited publishers 2013	978-81-224-3353-1
3	Modern control engineering	K. Ogata, 2nd edition Prentice Hall of India, 1990	13: 978-9813026940
4	Control System Analysis and Design	K. K. Agrawal. Khanna Publishers, 1994	8174092571
5	Feedback and Control System	Joseph J Distefano III et al., Schaum's Outlines, Tata Mcgraw Hill, 2nd Edition 2007.	9780071829489

6	Principles of Control Systems	S P Xavier Eugene and J Joseph Cyril Babu , S. Chand & Company Pvt. Ltd.2006	9788121917780 8121917786
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❖ **E-REFERENCES:**

- <https://electronicscoach.com/control-system.html> accessed on 23rd January 2022
- <http://nptel.ac.in/courses/108101037/31> accessed on 24th January 2022
- <http://engineeringppt.blogspot.in/2011/08/control-systems.html> accessed on 24th January 2022
- https://www.tutorialspoint.com/control_systems/index.htm accessed on 24th January 2022
- <https://www.youtube.com/watch?v=OYPXiC7QjUM> accessed on 24th January 2022

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

- Digital Multi-meter 3.5 digit with R , V, I measurements, diode and BJT testing
- Cathode Ray Oscilloscope Dual Channel, 4 Trace CRT / TFT based
 - Bandwidth 20 MHz/30 Mhz
- Function Generator 1 MHz , sine, square, triangular, ramp and pulse generator Freq range 0.01 Hz to 1 Mhz, Output amplitude 20V open circuited, Output impedance 50 ohms.
- Regulated Power Supply 0- 30 Volt, 2 A with digital display

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Dr. M. N. Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Ms. S. S. Pampattiwar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Shri. Sandip V. Darwhekar	Director , Beta Computronics Pvt. Ltd.	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
6	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

 (Member Secretary PBOS)

 (Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN ELECTRONICS AND TELECOMM. ENGG.

COURSE CATEGORY: PROGRAMME ELECTIVE COURSE

COURSE CODE : EC307G

COURSE TITLE : INDUSTRIAL AUTOMATION

TEACHING SCHEME: TH: 03; TU: 00; PR: 02(CLOCK Hrs.)

TOTAL CREDITS : 04 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)

TH. TH. TEE EXAM : 03 HRs

PR. TEE EXAM : 02 HRs

PT. EXAM : 01 HR

❖ RATIONALE:

Industrial automation forms a major part of a production or process industry setup. This course will enable the students to evaluate the complexity of different process variables in industry, which includes different process measuring instruments and related transducers. Students will appreciate the importance and limitation of different types of process controls and actual control.

❖ COURSE OUTCOMES:

After completing this course students will be able to—

1. Identify various types of automatic process control.
2. Use the various controllers in process system.
3. Select the various blocks from internal architecture of PLC.
4. Develop and execute PLC program using Ladder logic diagram for various operations.
5. Describe the SCADA systems with given points.
6. Illustrate the fuzzy logic control in given applications.

❖ **COURSE DETAILS:****A.THEORY:**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs
1. Introduction to Automatic Process Control	1a. Identify various types of automatic process control. 1b. Describe the given automatic process control.	1.1 Introduction of process control: Types, Hydraulic, pneumatic and electronic control. 1.2 Automatic Process Control: Need of automatic process control, basic elements, block diagram, advantages and disadvantages, types	04
2. PID Controllers	2a. Apply various modes of process control system. 2b. Use the various composite controllers in process system. 2c. Use various Tuning methods of controllers.	2.1 Discontinuous and Continuous modes: ON-OFF controllers, output equation, neutral zone, Proportional(P) controllers, offset, Proportional band, Integral(I) controllers, Derivative(D) controllers, Response of P, I and D controllers 2.2 Composite controllers:PI, PD, PID controllers, output Equations, Response, Comparison, Relative merits and Demerits 2.3 Tuning methods of PID controllers	08
3. Programmable Logic Controllers (PLC)	3a. Compare PLC and wired logic system. 3b. Select the various blocks from Internal architecture of PLC. 3c. Describe various discrete, analog input and output modules.	3.1 Introduction to PLC: Advantages of PLC over wired logic system, Fixed and Modular PLCs, advantages and disadvantages of modular and fixed PLCs, Selection criteria, operation modes and applications 3.2 Internal architecture of PLC, block diagram of PLC, working and function of each blocks such as central processing unit (CPU), Power supply, ROM, RAM memory, Input and Output modules. 3.3 Input and output modules: circuit diagram, description of discrete and analog input/output modules, sinking and sourcing	06

4. PLC Programming	4a. Develop and execute PLC. program using Ladder logic diagram for various operations. 4b. Use PLC programming for control of process tank and conveyor motor.	4.1 PLC programming: Ladder logic diagram, scanning cycle, speed of execution I/O addressing Instruction , Bit Instructions Arithmetic and Logical instructions, Timer and counter instructions, Move and compare instructions , Program Control and Trigger function instructions 4.2 PLC programming examples based on above instruction using Ladder programming language, control of process tank and conveyor motor	18
5. Supervisory Control and Data Acquisition System (SCADA)	5a. Describe the SCADA systems with given points.	5.1 SCADA systems: features, Significance, selection criteria, Block diagram, Remote terminal unit(RTU), Applications, Types, Distributed SCADA system	06
6. Fuzzy Logic Controller (FLC)	6a. Describe the given terms of fuzzy logic. 6b. Select the given blocks of FLC. 6c. Illustrate the fuzzy logic control system in given applications.	6.1 Concept of fuzzy logic, triangular membership function 6.2 Fuzzy Logic Controller: block diagram, functions of each blocks closed loop system involving FLC 6.3 Application of fuzzy logic control in washing machine	06
Total Hrs.			48

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs .
1	Prepare report of survey on different types of PLCs available in market.	Programmable Logic Controllers(PLC)	02
2	Perform various operations using given instructions of PLC. (a) Bit Instructions (b) Arithmetic and Logical instruction (c) Timers and Counter instructions (d) Move and Compare instructions	PLC Programming	02
3	Develop and Execute ladder logic program for ON OFF control of lamp		02
4	Develop and Execute ladder logic program for lamp ON and OFF using timer and counter		02

5	Develop and Execute ladder logic program for stepper motor		02
6	Develop and Execute ladder logic program for temperature controller		04
7	Develop and Execute ladder logic program for traffic lights indication.		04
8	Develop and execute ladder logic program for bottling process used in industries.		04
9	Prepare visit report on any two applications of SCADA system in various fields.	Supervisory Control and data Acquisition System (SCADA)	04
10	Design the FLC based control system in washing machine using MATLAB.	Fuzzy Logic Controller (FLC)	04
Total Hrs.			32

❖ SPECIFICATION TABLE FOR THEORY PAPER:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
1	Introduction to Automatic Process Control	02(00)	03(03)	03(03)	08(06)
2	PID Controllers	02(02)	06(03)	06(00)	14(05)
3	Programmable Logic Controllers (PLC)	02(00)	06(06)	06(00)	14(06)
4	PLC Programming	02(02)	00(00)	03(03)	05(05)
5	Supervisory Control and Data Acquisition System (SCADA)	02(02)	03(00)	06(06)	11(08)
6	Fuzzy Logic Controller (FLC)	02(00)	03(03)	03(03)	08(06)
	Total	12(06)	21(15)	27(15)	60(36)

R – Remember

U – Understand

A – Analyze / Apply

❖ QUESTION PAPER PROFILE FOR THEORY PAPER:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
1	1	R	2	2	R	2	3	R	2	4	R	2	5	R	2	6	R	2	6/9
	2	R	2	4	R	2	5	R	2										
2	2	U	3	3	U	3	1	U	3	1	U	3	2	R	3				3/5
3	2	U	3	5	A	3	1	R	3	1	U	3	3	U	3				3/5
4	6	U	3	5	A	3	5	U	3	6	U	3	3	U	3				3/5
5	3	U	3	4	A	3	6	A	3	4	U	3	6	U	3				3/5
6	3	A	6	2	A	6	5	A	6										2/3

T- Unit/Topic Number

L- Level of Question

M- Marks

R-Remember

U-Understand

A-Analyze/ Apply

❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	25	--	Test Answer Scripts	1, 2,3,4,5,6
		Class Room Assignments		Assignments	15	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	60	24	Theory Answer Scripts	1,2,3,4,5,6
				Total	100	40		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Practical Answer Scripts	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1,2,3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Drawing ladder diagram, selection of equipments. writing program, execution etc.	10
2	Performance	20
3	Output Result, Procedure adopted for PLC programing (if any)	10
4	Viva voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	3	3	-	-	3	-	-	-	1
2	3	3	-	-	3	-	-	-	-
3	3	3	-	-		-	3	-	-
4	3	3	2	2	3	-	2	1	1
5	3	3	2	2	3	2	2	1	1
6	3	3	2	2	3	2	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

Sr. No.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Process Control Instrumentation Technology	C. D. Johnson, John Wiley & Sons, 3 rd Edition 1988	978-0471853404
2	Programmable logic Controllers	F. D. Petruzella, Tata McGraw Hill, 4 th Edition 2010	978-0-07-351088-0
3	Industrial instrumentation & control	S. K. Singh, Tata-McGraw Hill, 3 rd Edition 2009	978-0-07-026222-5

4	Introduction to programmable logic controllers	Garry Dunning, Thomson, 3rd Edition 2005	978-1401884260
5	Programmable logic controllers	W. Bolton, Newnes-Elsevier, 5 th Edition 2009	978-1856177511
6	SCADA: Supervisory Control and Data Acquisition System	Stuart A. Boyer, ISA, 4 th Edition 2009	978-1936007097
7	Fuzzy Logic with Engineering Applications	Timothy J. Ross, A John Wiley and Sons Ltd. Publication, 3 rd Edition 2010	978-0-470-74376-8

❖ E-REFERENCES:

1. <http://nptel.ac.in/courses/112102011/11>, Accessed on 18th September 2021
2. <http://nptel.ac.in/courses/112102011/12>, Accessed on 18th September 2021
3. <http://www.slideshare.net/rishabhshrivastava90857/an-introduction-to-scada> , accessed on 18th September 2021
4. <http://www.edgefxkits.com/blog/scada-system-architecture-types-application> Accessed on 18th September 2021
5. www.eng.unideb.hu/userdir/deak.krisztian/BOOK.pdf, Accessed on 18th September 2021
6. www.lu.lv/materiali/apgads/raksti/756_pp_193-203.pdf, Accessed on 18th September 2021

❖ LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:

1. PLC Trainer setup 05Nos.
2. WinTRiLOGI/ABB PLC simulator open source software.
3. Computer System - 20 Nos.
4. Consumable as needed in application suggested by concern Faculty.

❖ LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Prof. J. P. Kelwade	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Dr. M. N. Bawane	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip V. Darwekar	Director , Beta Computronics Pvt. Ltd.	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROJECT AND INTERNSHIP
COURSE CODE	: EC351G^{\$}
COURSE TITLE	: PROJECT ^{\$}
TEACHING SCHEME	: TH: 00; TU: 00; PR: 04 (CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT =2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: 02 HR
PT. EXAM	: --

❖ **RATIONALE:**

The project work is to introduce final year students to professional engineering practices. In project work students are engaged in the analysis, synthesis and application of the courses covered in their studies and to undertake & tackle an independent problem related to Electronics and Telecommunication Engineering. This course is very useful for understanding the higher level knowledge in the field of Electronics and Telecommunication engineering.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Identify, analyze and define the problems in Electronics and Telecommunication Engineering field.
2. Find different solutions to the problem by collecting data and select most appropriate solution using latest practices in Electronics and Telecommunication Engineering.
3. Use and integrate knowledge of different courses and data collected to make simple design with the help of Handbook, standard data manuals and journals.
4. Perform project work independently as a leader as well as member of a team.
5. Assess the impact of the project on society.
6. Prepare and present project report.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and Subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Perform introductory Task - Form project batch of four-five students - Select project as per area of interest - Select topic / industrial problem / work by consulting the guide from following list 1.New electronic equipment/ Instrument/ gazette etc. 2.Microcontroller /Digital circuit based /analog based applications. 3.Communication based application using transmitter /Receiver. 4.PLC based applications. 5.PC based applications. 6.Modification and expansions of old project , existing Instrument etc. 7.Industry based project. 8.Recent development. 9.Simulation Based project. Perform Literature Survey - Refer various Periodicals, Journals, Books, Internet literature related to project topic - Note down findings - Prepare database of collected literature on the basis of title, area of work, methodology used, type of work - Analyze industrial need - Prepare brief report	1. Introductory task and Literature Survey	10
2	Plan project Prepare Synopsis in standard format which includes following. Title Page: Project Title, Purpose of submission, Institute logo, Students Name, Guide Name, Department and Institute Name	2. Planning	10

	• Use Latex for preparing synopsis. • Submit the Synopsis to guide. • Approve synopsis from guide • Prepare action plan of project activities(Day wise action plan up to completion of project) • Submit the action plan to guide. • Approve action plan from guide		
3	I. Perform Preliminary Project work- • Prepare component list with specification of selected project. • Procurement of components. • Test the component with testing instruments • Build circuit of project on bread board and test II. Fabricate Project work- • Prepare the PCB art work for selected project using software. • Prepare the PCB ,test the PCB. • Prepare component layout on PCB and Solder all components.	3.Project Work	15
4	Test Project work- • List the major equipment for testing of project • Carry out stage wise test ,find fault and rectify. • Test final functional output. • Prepare, design and fabricate front panel and cabinet required for project. • Perform the final test for finished product of project. • Calculate the cost of project.	4. Testing	15
5	Prepare project report in standard format, which includes following. • Title Page which includes: Project Title, Purpose of submission, Institute logo, Students Name, Guide Name, Department and Institute Name • Certificates: Student declaration, Certificate from guide • Acknowledgement • Abstract. • Table of contents • List of Tables	5. Project Writing	10

	- List of Figures - List of abbreviations and acronyms (if any) - Text 1. Introduction, objectives 2. Literature Survey 3. Methodology/Materials/Methods/Estimate. 4. Results 5. Summary/Conclusion./Future Scope 6. References Use Latex for preparing report. Perform plagiarism check from free internet site. - Submit report of plagiarism check to the guide with project report		
6	Present project work - Prepare power point presentation of work done. - Prepare yourself to handle examiner questions after presentation. - Practice group presentation. - Present before guide.	6. Presentation	04
Total Hrs			64

C. Project Report:

Students will prepare a “Project Report” with following contents

- Title page (with the name of team members and mentor teacher)
- Certificate
- Acknowledgements
- Abstract
- Content page

Chapters

1. Chapter:1 Introduction
2. Chapter:2 Literature Survey
3. Chapter:3 Scope of the project
4. Chapter:4 Methodology
5. Chapter:5 Details of designs, working and processes
6. Chapter:6 Results and applications
7. Chapter:7 Conclusions and future scope

8. Appendix (if any)
9. References and Bibliography

Note: The report should contain diagrams, figures and charts etc as relevant for the project.

❖ **SPECIFICATION TABLE FOR THEORY PAPER:**
NIL

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER**
NIL



❖ ASSESSMENT AND EVALUATION SCHEME:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	--	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assign-ments	--	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	Theory Answer Scripts	1,2,3,4,5,6
				Total	--	--		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	100	--	Project Diary,Notes, Model, Assembly	1, 2, 3,4,5,6
		Journal Writing		Assign-ments	--	--	Journal	1, 2, 3,4,5,6
				Total	100	40		
	TEE (Term End Examination)	End Exam	Students	End of the Course	100	40	Project Report, Model, Assembly	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form		1, 2, 3, 4,5,6	
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Identification of Topic	10
2	Punctuality and overall contribution	
3	Project Diary	
4	Execution of Project Work	20
5	Project Report including documentation	20
6	Presentation	20
7	Question and Answer	30
	TOTAL	100

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	3					3		
2	3	3	3	3			3	3	3
3	3	3	3	3			3	3	3
4	3					3	3		
5	3	3			3		3		
6	3					3	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	PCB Technology	R. S. Khandpur, Tata McHill, 2005	0070588147
2	PCB Design & Technology	W. C. Bosshart Tata McHill, 1984	0074515497
3	PCB Design Software user manual	Myer Kutz, McGraw- Hill	0-07-141041-4
4	Data manuals from different manufacturers	Data Manual	0521202728
5	Hand books on PCB design	Coombs' Printed Circuits Handbook (McGraw-Hill Handbooks)	0071350160
6	Journals On Electronics field	Like Elektor, Electronics for you , Electronic product finder etc.	

❖ **E-REFERENCES:**

- www.electronics-project-design.com/ , accessed 23rd December 2022.
- <http://electronicsforu.com/> , accessed on 23rd December 2022.
- <http://www.electronicshub.org/electronics-projects-ideas/> , accessed on 23rd December 2022.
- <http://nevonprojects.com/project-ideas/electronics-ideas/> , accessed on 23rd December 2022.
- <http://www.omnicircuitboards.com/blog/bid/254057/Printed-Circuit-Board-Design-Techniques-and-Best-Practices> , accessed on 23rd December 2022.

❖ **LIST OF MAJOR EQUIPMENTS / INSTRUMENTS WITH SPECIFICATION:**

1. Cathode Ray Oscilloscope- 0 to 50 MHz
2. Digital Storage Oscilloscope-o to 50 MHz.
3. Function Generator.-0 to 50 MHz
4. LCR Q meter.
5. Digital Multi-meter

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

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1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
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3	Mrs. U. M. Ramteke	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Ms. S. S. Pampattiwar	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
5	Mr. Sandip Darvekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
6	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
7	Mr. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)

(Chairman PBOS)

Appendix
Suggestive Project Diary Format

Week No.:
Activities Planned:
Activities Executed:
Reason for delay if any
Corrective measures adopted
Remark and signature of the Guide

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME	: DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING
COURSE CATEGORY	: PROGRAMME CORE COURSE
COURSE CODE	: EC352G
COURSE TITLE	: E-SIM (ONLINE COURSE)
TEACHING SCHEME	: TH:--; TU: --;PR: --(CLOCK HRs.)
TOTAL CREDITS	: 02 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCK HR.)
TH. TEE EXAM	: --
PR. TEE EXAM	: --
PT. EXAM	: --

❖ **RATIONALE:**

ESim (previously known as OScad / Free EDA) is a free/ libre and open source EDA tool developed by the FOSSEE team at IIT Bombay. It can be used for circuit design, simulation, and PCB design. It also supports mixed-mode simulation. This online course is introduced to final year students in order to get familiarize with Circuit designing, Simulation of circuit and designing PCB for the same circuit which will help them as a step by step guide to develop their final year project.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to—

1. Create Circuit Schematics.
2. Simulate different circuits.
3. Create PCB Layout for different circuits.
4. Build SPICE models for different semiconductor devices.
5. Build Subcircuits at schematic level.
6. Realize different components in digital domain using NGHDL Tool.

❖ **COURSE DETAILS:****A. LIST OF PRACTICALS / LABORATORY EXPERIENCES / ASSIGNMENTS:**

Practicals	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Introduction to eSim	--	02
2	Create Circuit Schematic • Generate netlists for simulation and PCB design. • Perform Electric Rules Check (ERC). • Create new components using Library Editor	--	06
3	Perform Circuit Simulation • Analog, digital and mixed signal circuit simulations. • Perform AC, DC, DC operating point and Transient analyses. • Interactive Python plotting.	--	06
4	Create PCB Layout • Design multilayer PCB layouts. • Create custom footprints or Modify the existing footprints per requirement. • Export the design in formats such as Gerber, PDF, SVG and several other formats.	--	06
5	Model Builder • Create/upload spice model for semiconductor devices. • Modify or edit existing spice models for semiconductor devices.		04
6	Subcircuit Builder • Create a new subcircuit at schematic level. • Edit existing subcircuits down to schematic level.		04
7	NGHDL • Using NGHDL, user can create custom digital models using VHDL language. From simple multiplexers, counters to microcontrollers and ASICs, any custom component in the digital domain can be realized using the NGHDL tool.		04
Total Hrs			32

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
	TEE (Term End Examination)	End Exam	Students	End of the Course	50	20	Certificates of Online Exam	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	End of The Course	Student Feedback Form		Questionnaires	1, 2, 3, 4,5,6
	End of Course Survey							

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	1	2
1	3	--	1	3	--	--	3	--	--
2	3	--	--	3	--	--	3	--	2
3	3	--	--	3	--	--	3	--	--
4	3	--	--	3	--	--	3	--	--
5	3	--	--	3	--	--	3	--	--
6	3	--	--	3	--	--	3	--	--

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

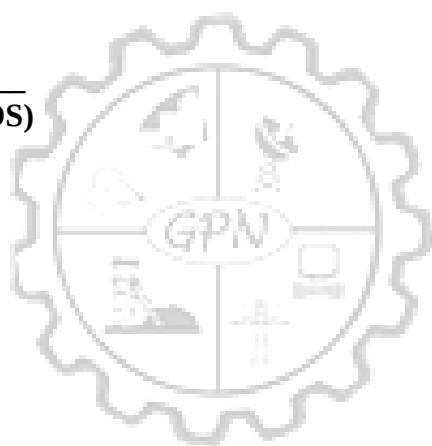
❖ **E-REFERENCES:**

- eSim: <https://esim.fossee.in>
- Circuit Simulation Project: <https://esim.fossee.in/circuit-simulation-project>
- Lab Migration: <https://esim.fossee.in/lab-migration-project>
- Forum: <https://esim.fossee.in/forum>
- Spoken Tutorials: <https://esim.fossee.in/downloads/tutorials>
- Github repository: <https://github.com/FOSSEE/eSim> ,
<https://github.com/FOSSEE/nghdl>

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. R. V. Yenkar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
2	Dr. V. H. Mankar	Head of Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
3	Ms. A. S. Aghav	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Nagpur.
4	Mr. S. V. Darwhekar	Director , Beta Computronics Pvt. Ltd. Nagpur	Beta Computronics Pvt. Ltd. Nagpur
5	Mrs. Gazala Ali	HOD, Electronics Engineering	Anjuman Polytechnic, Nagpur.
6	Prof. Kapil Pachpor	Lecturer in Electronics & Telecomm Engineering	Government Polytechnic, Amravati.

(Member Secretary PBOS)



(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.

(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN AE/AI/CM/CE/EC/EE/IT/MC/ME/MT/
PK/TX/TR

COURSE CATEGORY: HUMANITIES AND SOCIAL SCIENCE COURSE

COURSE CODE : ES351G

COURSE TITLE : ENTREPRENEURSHIP AND START UP

TEACHING SCHEME : TH: 02; TU: 00; PR: 02 (CLOCK HRS.)

TOTAL CREDITS : 03 (1 TH/TU CREDIT = 1 CLOCK HR., 1PR CREDIT = 2 CLOCK HR.)

TH. TEE EXAM : --

PR. TEE EXAM : --

PT. EXAM : --

RATIONALE:

Entrepreneurship as a mind set and a way of looking toward opportunity, focus and creativity. It's about creating value for customers, investor, entrepreneur, gaining independent in engineering career. Taking bold risk and solving challenges with undefined solution to be an entrepreneur, you need to have the ability to innovate, to improve the old and invent the new. In recent times, our society is influenced by knowledge creation and technological advancements. Competencies affecting Innovation and creativity have become important in all walks of life, including business context. This makes entrepreneurship education even more important for enhancing quality of life. Entrepreneurship plays an influential role in the economic growth and development of the nation. As the world economy is changing so is the dynamism of the business world. The aim of this course is to instil and kindle the spirit of Entrepreneurship amongst students. The idea of this course is to create job providers rather than job seekers.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to

1. Develop Entrepreneurial mindset.
2. Select self-employment as a viable option for earning dignified career.
3. Adapt the dynamic changes happening in the economy to create employment.
4. Prioritize entrepreneurship as life-skills to improve quality of life and skills of creation to start up.

5. Evaluate opportunities for new creation with overall business Potential and weakness.
6. Develop leadership skill particularly in the area of entrepreneur leadership.

❖ **COURSE DETAILS:**

A. THEORY :

Units	Topics and Subtopics	Hrs.
1. Entrepreneurship Concept and Functions	1.1 Introduction to Entrepreneurship, Entrepreneurship – Concept, Functions and Need 1.2 Entrepreneurship – The Indian Scenario. 1.3 Business Environment and Domain knowledge	04
2. An Entrepreneur & Entrepreneurial Journey	2.1 Development of Entrepreneurial skill and inclination towards entrepreneurship. 2.2 Dimension of Entrepreneurship 2.3 Competencies and characteristics for entrepreneur.	05
3. Entrepreneurs-hip as Innovation and Start up	3.1 Entrepreneurs as problem solvers 3.2 Innovations and Entrepreneurial Ventures – Global and Indian 3.3 Idea generation, Incubation centre.	06
4. Understanding the Market	4.1 Market Concept 4.2 Micro and Macro Market Environment 4.3 Market Research – Concept and Marketing Mix	05
5. Business Finance and Project preparation	5.1 Business plan and project 5.2 Feasibility study of the project 5.3 Project report preparation	06
6. Resource Mobilization	6.1 Institutional Infrastructure to promote entrepreneurship 6.2 Selection and utilization of human resources. 6.3 Business Environment and start up	06

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Outline the success story of any Three entrepreneur from Your Discipline.	1.Entrepreneurship Concept and Functions	02
2	Outline the contribution of SME in GDP of India.	1.Entrepreneurship Concept and Functions	02
3	List out the Barriers faced by entrepreneurship.	1.Entrepreneurship Concept and Functions	02
4	Identify the entrepreneurial traits in students.	1.Entrepreneurship Concept and Functions	04
5	Elaborate the formation of family Business in case study format.	2.An Entrepreneur & Entrepreneurial Journey	02
6	Develop Case study on Technopreneurs like Infosys, UBER, and ZOMATO.	2.An Entrepreneur & Entrepreneurial Journey	06
7	Compose idea generation of new enterprises related to your branch.	3.Entrepreneurship as Innovation and Start up	04
8	Organization of technical feasibility report for the stakeholders and submission for approval.	4.Understanding the Market	04
9	Survey on SSI in your discipline.	5.Business Finance and Project preparation	04
10	List out the facilities and subsidy of SSI unit in your own discipline.	6.Resource Mobilization	02
Total Hrs.			32

❖ **SPECIFICATION TABLE FOR THEORY PAPER:** Nil❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:-**Nil

❖ **ASSESSMENT AND EVALUATION SCHEME:**

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	--	--	Test Answer Scripts	1, 2, 3,4,5,6
		Class Room Assignments		Assignments	--	--	Assignment Book	1, 2, 3,4,5,6
	TEE (Term End Examination)	End Exam	Students	End of the Course	--	--	Theory Answer Scripts	1,2,3,4,5,6
				Total	--	--		
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assessment of Practical	Students	End of Every Practical	20	--	Journal	1, 2, 3,4,5,6
		Journal Writing		Assignments	05	--	Journal	1, 2, 3,4,5,6
				Total	25	10		
	TEE (Term End Examination)	End Exam	Students	End of the Course				
Indirect Assessment	Student Feedback on course		Students	After First PT	Student Feedback Form			1, 2, 3, 4,5,6
	End of Course Survey			End of The Course	Questionnaires			

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Practical Content	20
2	Entrepreneur Skills Observed	10
3	Result and Conclusion	10
4	Viva Voce	10
	TOTAL	50

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (COs)	Program Outcomes (POs)							Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	1	2	3
1					3	3	3			
2					3	3	3			
3					3	3	3			
4					3	3	3			
5					3	3	3			
6					3	3	3			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S.N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Entrepreneurship Development and Small Business Management.	Charantimath, P.M.	
2	Entrepreneurship Development in India.	Gupta C.B.	
3	Fundamental of Entrepreneurship and Small Business Management	Himalaya Publishing House.	

❖ **E-REFERENCES:**

1. Harvard Business Review
2. Business India/Business Today/Business World, University News
3. The Journal of Entrepreneurship by SAGE Publisher.
Journals.sagepub.com/home/joe
4. The journal of Entrepreneurship and Innovation in Emerging Economies by SAGE Publisher, journals.sagepub.com/home/eie.
5. International journal of Entrepreneurship and small Business by Inderscience Publisher, www.inderscience.com/ijesb
6. Vikalp Prabandhan

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

Nil

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr.C.P.Kapse	In Charge Head of Deptt, Textile Technology	Government Polytechnic, Nagpur.
2	Dr.G.K.Awari	Head of deptt. , Automobile Engg. Deptt.	Government Polytechnic, Nagpur.
3	Dr.K.S.Dixit	Lecturer, Automobile Engg.Deptt.	Government Polytechnic, Nagpur.

(Member Secretary PBOS)

(Chairman PBOS)

GOVERNMENT POLYTECHNIC, NAGPUR.
(An Autonomous Institute of Govt. of Maharashtra)

COURSE CURRICULUM

PROGRAMME : DIPLOMA IN CE/ME/EE/EC/CM/IT/AE/MT/PK/TX/
TR/MC/AIML

COURSE CATEGORY : PROJECT AND INTERNSHIP

COURSE CODE :IN351G

COURSE TITLE :INTERNSHIP

TEACHING SCHEME :TH: 00; TU: 00; PR: 30 (CLOCK Hrs.)

TOTAL CREDITS :15 (1 TH/TU CREDIT = 1 CLOCK HR., 1 PR CREDIT = 2 CLOCKHR.)

Table: Credit framework for Internship.

Sr. No.	Suggested Schedule	Suggested Duration	Activities	Credits
1.	6 th Semester	16 Weeks	Inter/Intra Institutional activities	15
			Industries/Govt./Non-Govt./NGO/ Rural Internship/Innovation/Entrepreneurship/Research Organizations	
			Seminars/Presentations/Internal Evaluation Work	
			Seminars/Presentations/External Evaluation Work	

TH. TEE : --

PR. TEE : 02 HRs

PT. EXAM : --

❖ **RATIONALE:**

Internship is educational and career development opportunity, providing practical experience in a field or discipline. Industrial training is the demonstration of technical knowledge acquired by the students during their course work. This course provides an opportunity to the students to identify and solve real life problem of the industries / research organizations / society. The main aim of this initiative is enhancement of the employability skills of the students passing out from the institute.

The aim of the polytechnic education is to create a pool of skill based manpower to support shop floor and field operations as a middle level link between technicians and engineers. Diploma pass out plays an important role in managing shop-floor operations. Therefore, it is necessary to the diploma pass out to get acquainted with the actual shop floor operations in the industry. This course has been designed to give actual working environment exposure to the diploma students.

❖ **COURSE OUTCOMES:**

After completing this course students will be able to–

1. Improve career related skills
2. Adopt industrial safety practices
3. Originate survey, related to industrial processes.
4. Appraise industrial working environment.
5. Elaborate Industrial problems
6. Compile, prepare and present report on activities carried out.

❖ **COURSE DETAILS:****A. THEORY :**

Units	Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Nil			

B. LIST OF PRACTICALS/LABORATORY EXPERIENCES/ASSIGNMENTS:

Practical No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1	Improve Career related activities • Soft Skills • Presentation skills • Career Guidance • Resume Writing skills • Group Discussion skills • Interview skills • Business Etiquette • Effective Email writing • Telephone etiquette • IT Foundation skills • Do's and Don'ts to be followed in Industry • Safety Practices	Orientation / Training	60
2	Adopt Industrial Safety Practices • Talk to safety officer • Record the safety practices to be followed in industry. • Record Don'ts and Do's. • Follow all instructions.	Safety Practices	60
3	Originate survey, related to the Industrial Process • Collect information regarding various processes carried out in an industry by discussing the allotted supervisor/officer • Note down findings • Prepare brief report	Survey	90
4	Appraise industrial working environment • Follow instructions of supervisor • Observe industrial processes • Record daily work done in diary	Working Experiences	120

❖ **SPECIFICATION TABLE FOR THEORY PAPER:** Not Applicable

❖ **QUESTION PAPER PROFILE FOR THEORY PAPER:** Not Applicable

❖ **ASSESSMENT AND EVALUATION SCHEME:**

☐	What		To Who m	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous)	Progressiv e Test (PT)	Students	Two PT (average of two tests will be computed)	--	--	--	--
		Assignment s		Continuous	--	--	--	--
	TEE (Term End)	End Exam	Stude nts	End of the Course	--	--	--	--
				Total	--	--	--	--
Direct Assessment Practical	CA (Continuous Assessment)	Continuous Assesmen t of Practical	Students	End of Every week	40	--	Rubrics, Assessme nt Sheets & Report	1,2,3,4,5,6
		Report Writing		Continuous	10	--	Report	1,2,3,4,5,6
		Presentation and Viva-Voce		End of the Course or last two weeks	50	--	Rubrics, Report & Presentatio n	1,2,3,4,5,6
				Total	100	40		
	T E E	End Exam	Stude nts	End of the Course	100	40	Rubrics, Report & Presentati on	1, 2, 3, 4,5,6
	Indirect Assessment	Student Feedback on course		Stude nts	After First Progressive Test	Student Feedback Form		1, 2, 3, 4,5,6
End of Course		End of The Course	Questionnaires					

❖ **SCHEME OF PRACTICAL EVALUATION:**

S.N.	Description	Max. Marks
1	Selection of industry	10
2	Survey	10
3	Work done and Feasibility of work/ problem identified	20
4	Report writing	10
5	Presentation Skills and Viva-Voce	50
Total		100

❖ **MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:**

Course Outcomes (Cos)	Program Outcomes (POs)							PSOs	
	1	2	3	4	5	6	7	1	2
1	2	-	2	2	3	3	3	3	3
2	2	3	3	3	2	3	3	3	3
3	3	3	3	3	-	2	3	3	3
4	-	2	3	2	-	3	3	3	3
5	2	3	3	2	1	3	3	3	3
6	-	2	2	-	-	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

❖ **REFERENCE & TEXT BOOKS:**

S. N.	Title	Author, Publisher, Edition and Year of Publication	ISBN Number
1	Industrial Training and Education	Lokesh Choudhary, Mittal Publications, 2007	10: 8183242367 13: 9788183242363
2	Training Practice	Penny Hackett, McGraw-Hill Education, September 2003	10: 0852929803 13: 9780852929803

❖ **E-REFERENCES:**

- <https://learning.tcsionhub.in/courses/career-edge-young-professional/>
- https://www.academia.edu/9360059/INDUSTRIAL_TRAINING_GUIDELINE_BOOK

❖ **LIST OF MAJOR EQUIPMENTS/INSTRUMENTS WITH SPECIFICATION:**

- DLP Projector
- Computers having latest specification

❖ **LIST OF EXPERTS & TEACHERS WHO CONTRIBUTED FOR THIS CURRICULUM:**

S.N.	Name	Designation	Institute / Industry
1	Dr. M. V. Sarode	Head of Deptt., Computer Engg. Deptt and TPO	Government Polytechnic, Nagpur.
2	Dr. G. V. Gotmare	Lecturer	Government Polytechnic, Gondia.
3	Mr. Avinash Shende	Managing Director (Operation & Planning)	Virtual Galaxy InfoTech Pvt. Ltd. Nagpur
4	Mr. Sachin Pande	Managing Director (Business Development & Management)	Virtual Galaxy InfoTech Pvt. Ltd. Nagpur
5	Mr. Vijay Thakare	CEO	SimSoft Technologies Nagpur

(Member Secretary PBOS)



(Chairman PBOS)