Government Polytechnic, Mumbai

Department of Computer Engineering

Semester V

(Course Contents)

For P-19 Curriculum

Programme Diploma in Computer Engineering
(Sandwich Pattern)

Approved Copy

GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonoums Institute, Government of Maharashtra)

Teaching and Examination Scheme (P19)

With effect from AY 2019-20

Programme: Diploma in Computer Engineering (Sandwich Pattern) **Term / Semester - V**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
							Theory			PR	OR	TW	Total
		L	P	TU	Total		TH	TS1	TS2				
HU19102	Environmental Studies	--	2	--	2	2	--	--	--	--	25	25	**50**
CO19312	Software Testing	3	2	--	5	5	60	20	20	--	25	25	**150**
CO19313	Computer Security	3	2	--	5	5	60	20	20	25*	--	25	**150**
CO19314	Major Project	--	4	--	4	4	--	--	--	--	50*	50	**100**
CO19404	Network Management and Administration	3	4	--	7	7	60	20	20	25*	--	25	**150**
CO19405	Cloud Computing	3	2	--	5	5	60	20	20	-25*	--	25	**150**
CO19406	Data Analytics using R												
IT19304	Microcontroller and Embedded Systems												
IT19501	Entrepreneurship and Start-ups	--	--	2	2	2	--	--	--	--	--	50	**50**
CO19501	Interdisciplinary MOOC/Spoken Tutorial	--	5	--	5	5#	--	--	--	--	--	--	--
	Total	**12**	**21**	**2**	**35**	**35**	**240**	**80**	**80**	**75**	**100**	**225**	**800**
Student Centered Activity(SCA)					--								
Total Contact Hours					**35**								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

***** Indicates assessment by External Examiner else internal practical skill test , **#** indicates Self, on- line learning Mode, **@** indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour, TH- 2 hours 30 minutes, PR/OR – 3 hours per batch, SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours

Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator, Curriculum Development, Dept. of Computer Engineering

Head of Department Dept. of Computer Engineering

In-Charge Curriculum Development Cell

Principal

Programme : **Diploma in CE/ME/EE/EC/CO/IT/IS/LG/LT (Sandwich pattern)**										
Course Code: **HU19102**				Course Title: **Environmental Studies**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	**02**	**--**	**02**	**--**	**--**	**--**	**--**	**25**	**25**	**50**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Technicians working in industries or elsewhere essentially require the knowledge of environmental Studies so as to enable them to work and produce most efficient, economical and eco-friendly finished products. Solve various engineering problems applying ecosystem to produce eco – friendly products. Use relevant air and noise control method to solve domestic and industrial problems. Use relevant water and soil control method to solve domestic and industrial problems. To recognize relevant energy sources required for domestic and industrial problems. Solve local solid and e-waste problems.

Course Outcomes: Student should be able to

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Understand the suitable air, extent of noise pollution, and control measures and acts.
CO3	Understand the water and soil pollution, and control measures and acts.
CO4	Understand different renewable energy resources and efficient process of harvesting.
CO5	Understand Solid Waste Management & E Waste Management, ISO 14000, 45001 & Environmental Management.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Ecosystem** 1.1 Structure of ecosystem, biotic & Abiotic components 1.2 Food chain and food web 1.3 Aquatic (Lentic and Lotic) and terrestrial ecosystem 1.4 Carbon, Nitrogen, Sulphur, Phosphorus cycle 1.5 Global warming -Causes, effects, process, Green House Effect, Ozone depletion **Course Outcome: CO1 Teaching Hours : 6 hrs Marks: 03 (R- NA, U-NA, A- NA)**
2	**Air and Noise Pollution** 2.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler) 2.2 Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone

	separator, Electrostatic Precipitator) 2.3 Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler 2.4 Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution **Course Outcome: CO2 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)**
3	**Water and Soil Pollution** 3.1 Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition 3.2 Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis) 3.3 Causes, Effects and Preventive measures of Soil Pollution : Causes – Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-waste 3.4 Mangroves : Importance, benefits. **Course Outcome:CO3 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)**
4	**Renewable sources of Energy** 4.1 Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. 4.2 Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas 4.3 Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy 4.4 New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy **Course Outcome:CO4 Teaching Hours : 6 hrs Marks:05 (R- NA, U-NA, A- NA)**
5	**Solid Waste Management OR E- Waste Management, ISO 14000 & Environmental Management** **For Civil Engineering :** 5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste. 5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste 5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board. 5.4 Concept of Carbon Credit, Carbon Footprint. 5.5 Environmental management in fabrication industry. 5.6 ISO14000: Implementation in industries, Benefits, ISO 45001:2018 5.7 Role of MPCB in factory permit. 5.8 Green pro IGBC certification, its benefits **OR** **For Computer Engineering & Information Technology :** 5.1 E-Waste Electronic products which have become unwanted, non-working, obsolete 5.2 E-Waste Management Services 5.3 Separation of E-Waste from other waste

	5.4 Categorization of E-Waste into old working equipments, old computers, non-working components 5.5 Authorized Recycling Facilities 5.6 Refurbishing **OR** **For Electrical Engineering :** 5.1 Various e-waste sources, their constituents, and health impacts 5.2 e-Waste Problem in India 5.3 Initiatives on building awareness in e-waste management. 5.4 Current Status of e-Waste Management & Environmental (Protection) Act 1986 5.5 Development of waste recycling technologies. 5.6 Opportunities of e-Waste Management in India 5.7 e-Waste Management techniques **OR** **For Electronics Engineering & Instrumentation Engineering :** 5.1 Solid waste generation- Sources and characteristics of : E- waste, biomedical waste. 5.2 Toxicity due to hazardous substances in E waste and their impact 5.3 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste 5.4 Domestic E waste disposal and E waste management 5.5 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board. 5.6 Concept of Carbon Credit, Carbon Footprint. **OR** **For Leather Technology/ Leather Goods & Footware Technology :** 5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste. 5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste 5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board. 5.4 Concept of Carbon Credit, Carbon Footprint. 5.5 Environmental management in fabrication industry. 5.6 ISO14000: Implementation in industries, Benefits. 5.7 Solid waste management in leather and footwear industries **Course Outcome:CO5 Teaching Hours : 6 hrs Marks:07(R- NA, U-NA, A- NA)**

Note : Chapter 5 should be teach as per department mentioned.

List of tutorials:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1,2,3, 4,5	CO1,CO2, CO3,CO4, CO5	Prepare a write up on each unit (altogether 5 in number) that summarizes the whole unit and presents important points on it.	14
2	2,3	CO2,CO3	Visit to a local polluted site : Urban/Rural/Industrial/Agricultural and prepare a report	4

			based on visit.	
3	4	CO4	Visit to biomass plant and prepare a report based on visit.	6
4	5	CO5	Visit to municipal solid waste management organization **or** an authorized e-waste recycling plant and prepare a report based on visit.	6
Total				**30**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Environmental Studies	S.C. Sharma & M.P. Poonia Khanna Publishing House, New Delhi	ISBN: 978-93-86173-09-6
2	Understanding Chemistry	C.N.Rao Universities Press(India) Pvt. Ltd. 2011	ISBN:13-9788173712500
3	Waste water treatment for pollution control and reuse	Arceivala, Soli Asolekar, Shyam Mc-Graw Hill Education India Pvt. Ltd. New york, 2007	ISBN:978-07-062099
4	Elements of Environmental Pollution control	O.P.Gupta Khanna Publishing House, New Delhi	ISBN:13-9789382609667

E-References:

1) www.eco-prayer.org
2) www.teriin.org
3) www.cpcp.nic.in
4) www.cpcp.gov.in
5) www.indiaenvironmentportal.org.in
6) www.whatis.techtarget.com
7) www.sustainabledevelopment.un.org
8) www.conserve-energy-future.com
9) http://www.nationallibrary.gov.in

CO Vs PO and CO Vs PSO Mapping (Civil Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	1	1
CO3	3	3	2	2	3	3	3	--	1	1
CO4	3	3	2	2	3	3	3	--	1	1
CO5	3	3	2	2	3	3	3	--	1	1

CO Vs PO and CO Vs PSO Mapping (Mechanical Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	1	3	3	3	--	1
CO2	3	3	2	2	3	3	3	--	--
CO3	3	3	2	2	3	3	3	--	--
CO4	3	3	2	2	3	3	3	--	--
CO5	3	3	2	2	3	3	3	--	--

CO Vs PO and CO Vs PSO Mapping (Electrical Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	3
CO2	3	3	2	2	3	3	3	--	--	2
CO3	3	3	2	2	3	3	3	--	--	2
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	2

CO Vs PO and CO Vs PSO Mapping (Electronics Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	2
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	1

CO Vs PO and CO Vs PSO Mapping (Instrumentation Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	1	3	3	3	--	--
CO2	3	3	2	2	3	3	3	--	--
CO3	3	3	2	2	3	3	3	--	--
CO4	3	3	2	2	3	3	3	--	--
CO5	3	3	2	2	3	3	3	--	--

CO Vs PO and CO Vs PSO Mapping (Computer Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	--
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

CO Vs PO and CO Vs PSO Mapping (Information Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	3	--
CO2	3	3	2	2	3	3	3	--	2	--
CO3	3	3	2	2	3	3	3	--	2	--
CO4	3	3	2	2	3	3	3	--	2	--
CO5	3	3	2	2	3	3	3	--	3	--

CO Vs PO and CO Vs PSO Mapping (Leather Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

CO Vs PO and CO Vs PSO Mapping (Leather Goods & Footware Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engg.

Head of Department
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Computer Engineering (Sandwich Pattern)**										
Course Code: **CO19312**				Course Title: **Software Testing**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs.)	TS1 (1 Hr.)	TS2 (1 Hr.)	PR	OR	TW	Total
3	**2**	**--**	**5**	**60**	**20**	**20**	**--**	**25**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid-term and second skill test at the end of the term

Rationale:

Software Testing is the process of verifying a system with the purpose of identifying any errors, gaps or missing requirement versus the actual requirement. Software Testing is important because software bugs could be expensive or even dangerous. Learning this subject will help students to plan effective test approach and to find bugs in earlier phase of Software Development.

In addition, this subject will introduce Automation testing which will utilize student's creativity to explore new ways to test a system, and thus student will spend less time as a tester and more time being the Quality Analyst.

Course Outcomes: Student should be able to

CO1	Learn various types and levels of Software Testing.
CO2	Prepare various test cases for different types and levels of testing.
CO3	Prepare test plan for any application.
CO4	Identify bugs to create defects report to given application
CO5	Test software for performance measures using automated testing tools.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Software Testing** 1.1 Software Testing Background • What is a bug? • Why do bugs occur? • Cost of Bugs. 1.2 Introduction to Software Testing ,Definition of Software Testing, Role of Testing, Software Testing Myths. 1.3 Objectives of Testing 1.4 STLC(Software Testing Life Cycle) 1.5 V model of software testing 1.6 Advanced V model 1.7 What makes a good Software Tester 1.8 Software Testing Terms: Precision and Accuracy, Verification and Validation 1.9 Quality Assurance and Quality Control. **Course Outcome:CO1 Teaching Hours :11 Marks: 14 (R-6 , U-6 , A- 2)**
2	**Types of Software Testing** 2.1White Box Testing : Classification of White Box Testing • Static Testing- Inspections, Structured Walkthroughs, Technical Review • Structural Testing- Code Functional Testing, Code Coverage Testing, Code Complexity Testing (Cyclomatic Complexity). 2.2 Black Box Testing: Techniques for Black Box Testing, Requirement Based Testing, Positive and Negative Testing , Boundary Value Analysis, Decision Tables, Equivalence Partitioning. 2.3 Grey Box Testing: Advantages and Disadvantages, Techniques used for Grey Box Testing 2.4 Comparison of various Testing Types. **Course Outcome: CO2 Teaching Hours :08 Marks: 10 (R-6 , U-2 , A-2)**
3	**Levels of Testing and Special Tests:** 3.1 Unit Testing Driver, Stub. 3.2 Integration Testing: Decomposition Based Testing - Top-Down Integration, Bottom-Up Integration, Bi-Directional Integration. 3.3 System Testing: Recovery Testing, Security Testing, Performance Testing, Load Testing, Stress Testing, Usability Testing, Compatibility Testing. 3.4 User Acceptance Testing Acceptance Criteria, Alpha Testing, Beta Testing. 3.5 Special Tests: Accessibility Testing ,Smoke Testing and Sanity Testing, Regression Testing, Usability Testing. 3.6 Application Testing: Web based Testing. **Course Outcome: CO3 Teaching Hours :10 Marks:12 (R-4 , U-4 , A- 4)**

4	**Test Planning, Documentation and Bug Reporting:** 4.1 Test Plan: Goal of the Test Planning. 4.2 Test Planning Topics: Resource requirements , Tester Assignments , Test schedule, Test Case. 4.3Test Case planning Overview: Test design, Test Case, Test Procedures, Test Case Organization & Tracking. 4.4 Requirement Traceability Matrix. 4.5 Getting bugs fixed, Bugs Life Cycle. 4.6 Bug Tracking System: Test Incident Report, Manual Bug Reporting and Tracking. **Course Outcome:CO4 Teaching Hours : 08 Marks:12 (R- 2 , U- 6 , A-4)**
5	**Automated Tools :** 5.1 Limitations of Manual Testing and Need for Automated Testing 5.2 Advantages and Disadvantages of Using Tools 5.3 When to Use Automated Test Tools 5.4 Selecting a Testing Tool 5.5 Automated Test Tools: Selenium Webdriver, JUnit. 5.6 Features and importance of these Test Tools. **Course Outcome: CO5 Teaching Hours :08 Marks:12 (R- 4 , U-4 , A- 4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Software Testing	6	6	2	14
2	Types of Software Testing	6	2	2	10
3	Levels of Testing and Special Tests	4	4	4	12
4	Test Planning, Documentation and Bug Reporting	2	6	4	12
5	Automated Tools	4	4	4	12
	Total	**22**	**22**	**16**	**60**

List of Experiments: Total 10-12 experiments (or turns) out of 15-16 experiments (or turns)

Sr. No.	Unit No	Cos	Title of the Experiments	Hours
1	1	CO1	Study Software testing concept, types & methods.	02
2	2	CO2	Design and write test cases for simple calculator application.	02
3	4	CO4	Prepare Test Plan for Coffee Vending Machine.	02
4	4	CO4	Study Bug Life Cycle and reporting bugs for Instagram App.	02
5	5	CO5	Test Software using Selenium Webdriver.	02
6	1	CO1	Identify system specification & design test cases for Inventory management	02
7	2	CO2	Design a set of test cases for Flight Reservation System.	02
8	3	CO3	Study college website and report various bugs.	02
9	4	CO4	Prepare Test Plan for Railway Reservation System.	02
10	5	CO5	Study various automated testing tools.	02
11	5	CO1	Identify system specification & design test cases for Hotel Management System	02
12	4	CO2	Design a set of test cases for Social Media Platform (any one)	02
13	4	CO4	Prepare Test Plan for Student Admission Process.	02
14	5	CO5	Test software using Junit	02
15	4	CO4	Prepare test report, including test plan, test cases. (for any of your own mini/major project.)	02
		Total		**30**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Software Testing	Ron Patton	978-1466560680
2	Software Testing: Principles, Techniques and Tools	M. G. Limaye	9780070139909
3	Software Testing: Principles and Practices	Naresh Chauhan	9780199465873

E-References:

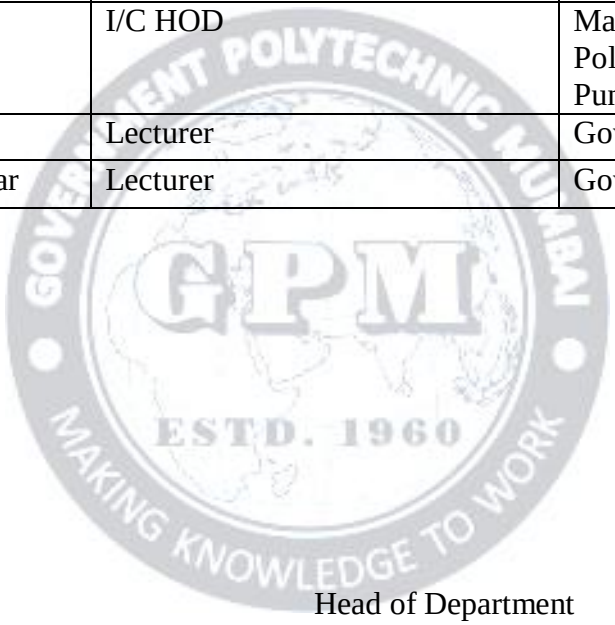
1.https://ndl.iitkgp.ac.in/
2https://www.tutorialspoint.com/software_testing/index.htm
3https://www.guru99.com/software-testing.html
4.https://www.selenium.dev/projects/

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	3	2	2
CO3	3	3	3	3	2	2	2	2	2	2
CO4	3	3	3	2	2	2	2	2	2	2
CO5	3	3	3	2	2	2	2	2	2	2

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Pawan Awachar	Software Engineer	GEP solutions private ltd
2	Mr. Vikas Solanke	I/C HOD	Marathwada Mitra Mandal Polytechnic.Thergaon Pune -33
3	Pooja S. Chame	Lecturer	Govt. Polytechnic Mumbai
4	Vinaya B Savadekar	Lecturer	Govt. Polytechnic Mumbai



Coordinator,
Curriculum Development,
Department of Computer Engineering

Head of Department
Department of Computer Engineering

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Computer Engineering(Sandwich Pattern)**										
Course Code: **CO19313**				Course Title: **Computer Security**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Mins)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
03	**02**	**--**	**05**	**60**	**20**	**20**	**25***	--	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

The aim of the course is to familiarize students with the basic problems of computer security. They will include the risks of information systems in the context of confidentiality, integrity and availability of information security policy development issues system, elements of cryptography, issues of electronic signatures and public key infrastructure, basic models of authentication, access control policies, security, communication protocols and application services.

Course Outcomes: Student should be able to

CO1	Identify the potential threats to confidentiality, integrity and availability of Computer Systems
CO2	Use cryptography algorithms and protocols to achieve Computer Security
CO3	Build systems that are more secure against attacks.
CO4	Apply security principles to secure Operating Systems and applications.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to computer security and security trends.** 1.1 Definition of Computer Security, Need for security, Security basics: Confidentiality, Integrity, Availability, Accountability, Non-repetition. Example of Security, Challenges for security.

	1.2 Risk and Threat Analysis: Assets, Vulnerability, Threats, Risks, Counter measures. 1.3 Threat to Security: Viruses and Worms, Intruders, Insiders, Criminal organizations, Terrorists, Information warfare ,Avenues of attack, steps in attack 1.4 Security attacks: Active and Passive attacks, Denial of service, backdoors and trapdoors, sniffing, spoofing, man in the middle, replay, TCP/IP Hacking, encryption attacks, Keyloggers 1.5 Malware : Viruses, Logic bombs. **Course Outcome: CO1 Teaching Hours : 06 Hrs Marks: 04 (R- 02 , U- 02 , A-)**
2	**Identification, Authentication and Operational Security** 2.1 User name and password, Managing passwords, choosing password. 2.2 Role of people in Security: Password selection, Piggybacking, Shoulder surfing, Dumpster diving, Installing unauthorized software/hardware, Access by Nonemployees, Security awareness, Individual User responsibilities 2.3 Access controls: Definition, principle, policies: DAC, MAC,RBAC. 2.4 Biometrics: finger prints, hand prints, Retina, patterns, voice patterns, signature and writing patterns. **Course Outcome: CO1 Teaching Hours : 06Hrs Marks:10 (R- 4 , U- 4 , A- 2)**
3	**Cryptography** 3.1Introduction:Cryptography,Cryptanalysis,Cryptology,Substitution techniques:Caesar's cipher, monoalphabetic and polyalphabetic, one-time pad. 3.2 Transposition techniques – Rail fence technique, simple columnar 3.3 Hashing – concept 3.4 Symmetric and asymmetric cryptography: Introduction to Symmetric encryption, Data Encryption Standard (DES),International Data Encryption Algorithm (IDEA),Advance Encryption Standard (AES-128).Asymmetric key cryptography :

	RSA (Rivest–Shamir–Adleman) algorithm, Diffie–Hellman key exchange (DH). 3.5 Digital Signature 3.6 Introduction to steganography **Course Outcome: CO2 Teaching Hours :13Hrs Marks: 14(R-02 ,U-04 , A- 08)**
4	**Computer Security Technology and Intrusion Detection** 4.1 Firewalls: Need for Firewall, limitations, characteristics. Types of Firewall : Hardware, Software, Packet filter, Proxy Server, Hybrid, Application gateways, circuit level gateway, Implementing Firewall. 4.2 Intrusion Detection: Intrusion detection systems (IDS), host based IDS, network based IDS, Honey pots. 4.3 Email security: Email security standards: Working principle of SMTP, PGP, S/MIME. **Course Outcome: CO3 Teaching Hours :08Hrs Marks :8 (R-02 , U-04 , A- 02)**
5	**Cyber Security** 5.1 Introduction to Cyber Crimes – Hacking, Cracking, Viruses,Virus Attacks, Pornography,Software Piracy, Intellectual property, Legal System of Information Technology, Mail Bombs, Bug Exploits, Cyber Crime Investigation 5.2 Introduction Cyber Laws- Introduction to IT act 2000 and IT act 2008, Introduction to the cyber laws. 5.3 Cyber Forensics: Cyber Forensic Introduction ,Forensic Tools and Techniques, Investigating the Crime Scene ,Rules of Evidence **Course Outcome: CO3 Teaching Hours :06 Hrs Marks:6(R- 02 , U- 04 , A-)**
6	**Application, Web & Database Security** 6.1 Application hardening, application patches, web servers, active directory. 6.2 Web security threats, web traffic security approaches, Secure socket layer and transport layer security, secure Electronic transaction

	6.3 Database Security: **S**QL Injection, Web Application & SQL Injection, SQL Injection prevention **Course Outcome:CO4 Teaching Hours :06 Hrs Marks:8 (R- 02 , U-04 , A- 02)**

Suggested Specifications Table (Theory):

Unit No.	Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1.	Introduction to computer security and security trends.	2	2	--	4
2.	Identification, Authentication and Operational Security	4	4	2	10
3.	Cryptography	2	4	8	14
4.	Computer Security Technology and Intrusion Detection	2	4	2	8
5.	Cyber Security	2	4	--	6
6.	Application, Web & Database Security	2	4	2	8
7.		**14**	**22**	**14**	**50**

List of experiments:

Sr.No.	Unit	Experiment/Assignment	Approx. Hours
1	1	Detect vulnerability which can allow null user and null session through pseudo account	2
2	2	Use keylogger to get confidential data.	2
3	3	Create Digital Signature document using Cryptool	2
4	3	Implement ceaser cipher &simple columnar techniques.	4
5	3	Encrypt & decrypt a plaintext using RSA algorithm.	2
6	3	Perform key exchange using DH algorithm	2
7	4	Filter packets according to protocol using any packet filtering tool.	2
8	4	Use Traceroute to get information about routers and firewalls.	2

9	4	Demonstrate buffer overflow attack.	4
10	4	Tracing of email origin using eMailTracePro utility	2
11	6	Perform SQLinjection on any website (HTMLget)	4
12	6	Tracing the path of an website/ web server using tracert utility	2
		Total	**30**

References/ Books:

Sr. No.	Book Title	Author	Publication
01	Cryptography and Network Security	Atul Kahate	Tata McGraw Hill
02	Computer Security Principles and Practices	William Stallings, Lawrie Brown	Pearson Education
03	Computer Security	Dieter Gollman	Wiley India Education (Second Edition)
04	Principles of Computer Security + and Beyond	Wm. Arthur Conkin Dwayne Williams Gregory B. White Roger L. Davis Chuck Cothren	Mc Graw Hill Technology Education international Edition 2005
05	Cryptography and Security	C K Shyamala, N Harini, Dr. T. R. Padmanabhan	Wiley India

E-Reference:

1. http://www.pgpi.org/doc/pgpintro
2. http://www.emailtrackerpro.com
3. http://www.kmint21.com
4. http://www.jjtc.com/Steganography/tools.ht

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	2	--	--	--	3	1	2	--
CO2	1	3	3	--	2	1	3	1	3	3
CO3	1	2	3	--	2	--	3	1	3	3
CO4	1	2	3	--	2	--	3	1	3	3

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr.Atul Jadhav	Director	Cybernist Pvt Ltd.
2	Mrs Madhuri Arde	Lecturer in Information Technology	Govt. Polytechnic Kolhapur
3	Mrs Shital Sutar	Lecturer in Information Technologg	Govt. Polytechnic Avasari
4	Mrs Rupali Molawade	Lecturer in Computer Engineering	Govt. Polytechnic Mumbai

Coordinator, Head of Department

Curriculum Development, Department of Computer Engineering

Department of Computer Engineering

I/C, Curriculum Development Cell Principal

Programme : **Diploma in Computer Engineering (Sandwich Pattern)**										
Course Code: **CO19314**				Course Title: **Major Project**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Mins)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
-	**4**	**-**	**4**	**-**	**-**	**-**	**--**	**50***	**50**	**100**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

In the field of Computer engineering various technologies (hardware and software) needs to be integrated and proper paradigm need to be implemented to develop any kind of computer applications. Hence it becomes essential to enhance skills in developing industrial applications. This course is essential to understand the implementation of the system development process i.e. design, analyze, coding, debugging and testing. This will help student to acquire skills and attitudes to work as a software developer.

Course Outcomes: Student should be able to

CO1	Works in groups, co-ordinate work, develop leadership qualities.
CO2	Identify the problem in any existing system.
CO3	Analyze the project requirements.
CO4	Choose relevant solution for the problem by using acquired practical knowledge.
CO5	Prepare project proposal including action plan.
CO6	Implement planned activity in a group/project implementation.
CO7	Write a project report.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Area of Selection for the project** These are only guidelines. Any innovative ideas related to Computer engineering field may be included: 1. Advanced Mobile Applications. 2. AI and Robotics. 3. Internet of Things.

	4. Networking 5. Animations. 6. Big data and data analytics. 7. Machine Learning. 8. Embedded Systems. 9. Designing software for IT applications. 10. Cyber security 11. Cloud Computing. 12. Interfacing of mobile devices with automated devices. 13. Image processing. **Course Outcome: CO1**
2	**Activity Plans: From Project Planning to actual Implementation** 1. Formation of groups. 2. Students are supposed to choose suitable domain/topic to work by doing Literature survey. Visit to industries/institutions/market fields (for sponsored projects). 3. Define problem statement for project work. 4. Submission of synopsis of the proposed work: by each group. (The project will be selected by approval of project guide. Synopsis document should be of 2-8 pages) 5. Progressive presentation of work. 6. Prepare a project proposal including action plan, methodology to carry out project work, So that it can be implemented smoothly. 7. Allocation of work responsibility to each group member. 8. Prepare system design including DFD, UML diagrams. 9. Actual implementation of planned work/project modules. 10. Testing of each module. 11. Assemble different modules together. 12. Progressive presentation of work. The activities should be monitored and guided by Project Guide every week during the contact hours provided for the same. The project diary should be maintained by student and get it checked by the Project Guide every week. **Course Outcome: CO1,CO2,CO3,CO4,CO5,CO6**
3	**Guidelines for writing Synopsis and Project report** **Contents of front page:** 1. Project title 2. Student name and enrollment number 3. Name of the Project Guide 4. Department **Contents of pages(page no. 2 onwards):** 1. Abstract 2. Introduction 3. Existing system problems

	4. Requirement specifications: hardware and software requirements. 5. Control flow diagram/block diagram **Format for report:** • Font type: Times New Roman • Font Size: headings- 14(bold), contents- 12 • Text Alignment: Justified • Line spacing: 1.5 • Header content: Name of the department at left side Title of the project at right side • Footer: Page number at center. **Course Outcome:CO5,CO7**

Learning Resources- Magazines:

Sr. No.	Title
1	IEEE Transactions Journals
2	Computer Today
3	PC Quest
4	Data Quest
5	Computer World
6	Any journal related to Computer/Information Technology/ Electronics field.

GOVERNMENT POLYTECHNIC MUMBAI GPM ESTD. 1960 MAKING KNOWLEDGE TO WORK

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	3	3	3
CO2	3	3	3	3	2	2	2	3	3	3
CO3	2	2	2	2	3	3	3	3	3	3
CO4	2	2	2	2	3	3	3	2	3	3
CO5	2	2	3	3	3	3	3	2	2	3
CO6	2	2	3	3	3	3	3	3	3	3
CO7	2	2	3	3	3	3	3	3	3	3

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Samit Kumar	Senior Project Associate	Cognizant Technology Solutions, Pune
2	Mrs. Megha Yawalkar	Lecturer in Computer Engineering	Govt. Polytechnic, Pune
3	Mrs. Vrushali Ashok Patil (Curriculum Content Designer)	Lecturer in Computer Engineering	Govt. Polytechnic Mumbai

Coordinator, Head of Department

Curriculum Development, Department of Computer Engineering

Department of Computer Engineering

I/C, Curriculum Development Cell Principal

Programme : **Diploma in Computer Engineering (Sandwich Pattern)**										
Course Code: **CO19404**				Course Title: **Network Management and Administration**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Mins)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	**4**	**--**	**7**	**60**	**20**	**20**	**25***	--	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale: To access remote programs, data, and hardware resources lying either on the same organization's computers or from other enterprises or public sources and for resource sharing, connecting the IT resources is the prime requirement of today. The computer networks makes this communication possible. In this scenario the management and administration of network in effective manner becomes an important aspect. The course introduces students to the fundamentals of network management, primarily for TCP/IP networks. The students of this course will be able to design, install, configure and experience hands-on management of typical network components. They will also be able to administer and manage the network. After learning this course student will be employable in the industry working in the area of network installation and management or they can start their own business providing hardware and software solutions to different organization in the area of networking.

Course Outcomes: Student should be able to

CO1	Identify Need of Network Management and Administration.
CO2	Explain Directory services and Remote Access
CO3	Demonstrate networking protocols and services.
CO4	Install and Configure Network Server Operating System
CO5	Creating and Managing User Accounts.
CO6	Troubleshooting Network.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Basics of Network Management** 1.1 Definition and need of Network Management and Administration 1.2 Network Management Requirements : Fault Management, Accounting Management Configuration and Name Management ,Performance Management ,Security Management. 1.3 Network Management Architecture : Network management system, Network management protocol, Managed devices, Managed Agents, Management information. 1.4 Roles and Responsibilities of System and Network Administrator. **Course Outcome: CO1 Teaching Hours : 6 hrs Marks: 08 (R- 2, U-4, A-2)**

2	**Exploring Directory Services and Remote Access** 2.1 Directory Services: Define Directory Service, Definition of Novell Directory, Windows Domain, MS Active Directory, X500 Directory Access Protocol, Lightweight Directory Access Protocol, Forests, Trees, Roots and Leaves. 2.2 Active Directory Architecture: Object Types, Object Naming, Canonical Names, LDAP Notation, Globally unique identifiers, User Principle Names, Domain, Trees & Forests. 2.3 Remote Network Access: Need of Remote Network Access, PSTN, ISDN, DSL, CATV. 2.4 Virtual Private Network: VPN Protocols, Types of VPN, VPN Clients, SSL VPNs. **Course Outcome: CO2 Teaching Hours : 08 hrs Marks: 10 (R- 2 , U-4 , A- 4)**
3	**Network Protocols and Services** 3.1 Dynamic Host Configuration Protocol(DHCP): DHCP Origins, DHCP Architecutre, Address Resolution Protocol, Reverse Address Resolution Protocol (RARP), The Bootstrap Protocol (BOOTP), IP Address assignments, Subnetting, Supernetting . 3.2 Introduction to Domain Name Systems (DNS): DNS Objectives, Domain Naming, Top Level Domains, Second Level Domains, Sub-domains, DNS Functions, Resource Records, DNS Name Resolution, Resolves, DNS Requests, Root Name Servers, Resolving a Domain Name, DNS Name Registration. 3.3 Network Printing Concepts: Locally Connected Print Devices, Setting up local Print Devices, Shared Print Devices, Sharing Locally Attached Print Devices, Describe Windows Network Printing and Add print Wizard. **Course Outcome: CO3 Teaching Hours :10 hrs Marks: 14 (R-4, U- 6 , A- 4)**
4	**Network Planning and Implementation** 4.1 Designing Network – Accessing Network Needs, Applications, Users, Network Services, Security and Safety, Growth and Capacity Planning, Meeting Network Needs – Choosing Network Type, Choosing Network Structure, Choosing Servers. 4.2 Installing and Configuring Windows Server - Preparing for Installation, Creating windows server boot disk, Installing windows server, Configuring server/ client. 4.3 Setting windows server - Creating Domain controller, Adding the DHCP and WINS roles, Adding file server and print server, Adding Web based Administration. **Course Outcome: CO4 Teaching Hours : 10 hrs Marks: 12 (R- 2 , U- 4 , A-6)**
5	**Network Configuration** 5.1 Working With User Accounts - Adding a User, Modifying User Account, Deleting or Disabling a User Account. 5.2 Working With Windows Security Groups – Creating Group, Maintaining Group Membership. 5.3 Working with Shares – Understanding Share Security, Cresting Shares, Mapping Drives 5.4 Administering Printer Shares – Setting up Network Printer 5.5 Working with Windows Backup – Using Windows Servers and Backup Software **Course Outcome:CO5 Teaching Hours : 06 hrs Marks:08 (R-2 , U- 4 , A-2)**
6	**Troubleshooting of Network** 6.1 Understanding the Problem – Troubleshooting, Segmenting the Problem, and Isolating the Problem, Setting Priorities. 6.2 Troubleshooting Tools – Hardware Tools, Software Tools, Monitoring and Troubleshooting Tools 6.3 Internal Security – Account Security, File and Directory permissions, Practices and user education **Course Outcome: CO6 Teaching Hours : 05 hrs Marks: 08 (R- 0 , U-4 , A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Basics of Network Management**	2	4	2	8
2	**Exploring Directory Services and Remote Access**	2	4	4	10
3	**Network Protocols and Services**	4	6	4	14
4	**Network Planning and Implementation**	2	4	6	12
5	**Network Configuration**	2	4	2	8
6	**Troubleshooting of Network**	0	4	4	8
	Total	**12**	**26**	**22**	**60**

List of experiments:

Sr. No.	Unit No	Cos	Title of the Experiments	Hours
1	1	CO1	Check System Configuration and Identify requirements for Network Management.	2
2	3	CO3	Execute TCP/IP utilities and commands. (eg: ping,ipconfig, tracert, arp, tcpdump, whois, host, netsat, nslookup, ftp,telnet,route,pathping etc...)	2
3	4	CO4	Installation and configuration of Windows server and client	2
4	4	C04	Installation and configuration of Linux server and client	2
5	4	CO4	Installation and configuration of SQL-Server on Client Server Network.	2
6	4	C04	Create client-server network for 1+10 pc in your Lab using private IP Addresses form Class A,B,C.Test and Verify Network Connectivity	4
7	3	C03	Create network using subnet mask to prepare small network inside larger network (logical grouping of connected network devices)	4
8	2	CO2	Configure Virtual LAN and verify communication between two VLANS.	2
9	3	CO3	Configure NAT (Network Address Translation)	2
10	4	CO4	Remote logging in one computer with another computer and device to device (Use telnet/Teamviewer/Anydesk or SSH for Linux)	2
11	2	CO2	Installing Active Directory & Creating Active Directory Objects	2
12	2	CO2	Create Domain Controller and join computers to domain.	2
13	4	CO4	Configure a router (Ethernet & Serial Interface) using router commands including access lists on any network simulator (eg.packet Tracer)	4
14	2	CO2	Configure VPN components and Set-up VPN.	4
15	3	CO3	Configuration of the following a) Remote Login Service – TELNET/SSH b) Configuration of FTP server and accessing it via FTP Client. c) Configuration of DHCP and DNS server.	4
16	4	CO4	Installation and Configuration of IIS Server.	2

17	4	C04	Setting up and Configuring Local Print Device and Network Print Device	2
18	5	CO5	Create new Users & assign privileges/ Permission.	2
19	5	CO5	Modify/ Delete/Deactivate Users and groups	4
20	6	CO6	Identify, Segment Network Faults and troubleshoot	4
21	4	CO4	Manage Microsoft Windows Internet Security Services (WINS)	4
22	6	CO6	Manage Desktop Configuration using Group Policy & Remote Installation Services.	2
Total				**60 hrs**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Data Communication and Networking	Behroz A. Forouzan	ISBN-13: 978-0073376226
2	The Complete Reference Networking	Craig Zacker, Tata MCgrawhill	ISBN-10: 9780070474161
3	Networking A Beginner's Guide	Bruce Hallberg,Tata MCgrawhill	**ISBN**-13: 978-0071633550
4	MCSE Training Kit Networking Essential Plus	Microsoft Press	

E-References:

1. https://ndl.iitkgp.ac.in/
2. www. nptel.com
3. www.tutorialpoints.com
4. www.cisco.com
5. www.udemy.com
6. www.netacad.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	2	2	2
CO2	2	2	2	3	2	2	2	2	2	2
CO3	3	3	3	3	2	2	2	3	3	3
CO4	2	2	3	3	2	2	2	3	2	2
CO5	2	2	2	2	2	3	2	2	2	2
CO6	2	3	3	3	3	2	2	3	2	2

Industry Consultation Committee:

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4	Mrs. Rupali Komatwar	Lecturer	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Computer Engineering

Head of Department
Department of Computer Engineering

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Computer Engineering and Information Technology (Sandwich Pattern)**										
Course Code: **CO19405**				Course Title: **Cloud Computing**						
Compulsory / Optional: **Optional for Computer Engineering** **Compulsory for Information Technology**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Mins)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	**2**	**--**	**5**	**60**	**20**	**20**	**25***	**--**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale: Cloud computing facilitates the access of applications and data from any location worldwide and from any device with an internet connection.It offers businesses with scalable computing resources hence saving them on the cost of acquiring and maintaining them.This course covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, Software as a Service, and Physical Systems as a Service. For different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com, etc. solutions as well as theoretical solutions are introduced.

Course Outcomes: Students should be able to

CO1	Describe the basic concepts of Cloud Computing.
CO2	Use concept of Virtualization in Cloud Computing.
CO3	Analyze various cloud storage systems.
CO4	Demonstrate cloud Monitoring and Management techniques.
CO5	Study and Use concept of Cloud Security.
CO6	Compare different available Cloud Platforms.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Cloud Computing** 1.1 From Client-Server and collaborative computing to Cloud computing,Defining cloud Computing, Essential characteristics of cloud computing. 1.2 Cloud Deployment Model: Public cloud, Private cloud, Community cloud, Hybrid cloud. 1.3 Cloud Service Models: IaaS, PaaS, SaaS. 1.4 Cloud Economics and Benefits 1.5 Architecture of Cloud computing 1.6 Cloud Computing Infrastructure **Course Outcome: CO1 Teaching Hours :06 Marks: 10 (R- 04 , U-04 , A-02)**
2	**Virtualization** 2.1 Introduction, Characteristics of virtualized environment 2.2 Virtualization Types

	2.3 Technology Example: Vmware, Microsoft Hyper-V, KVM , Xen 2.4 Advantages of Virtualization ,VM Migration,VM consolidation and VM Management 2.5 Disadvantages of virtualization **Course Outcome:CO2 Teaching Hours:07 Marks: 10 (R- 04 , U-04 , A-02)**
3	**Storage in Cloud** 3.1 Storage system architecture, 3.2 Virtualize Data Centre(VDC) :Architecture, VDC Environment, server,storage, networking 3.3 Block and file level storage virtualization, Virtual Provisioning, and automated storage tiering, 3.4 Virtual Storage Area Network(VSAN) and benefits,3.5 Cloud file systems: GFS and HDFS, Comparisons among GFS and HDFS. **Course Outcome: CO3 Teaching Hours :08 Marks: 10 (R- 04 , U-04 , A-02)**
4	**Cloud Monitoring and Management** 4.1 Cloud Service Provider and users 4.2 SLA(Service Level Agreement) management: Types of SLA, Life cycle of SLA. 4.3 Service catlog, management and functional interfaces of services 4.4 Cloud portal and its functions 4.5 Cloud Service life cycle phases: Service planning, service creation, service operation and service termination,4.6 Software defined approach and techniques for managing IT resources **Course Outcome:CO4 Teaching Hours :08 Marks: 10 (R- 04 , U-04 , A-02)**
5	**Security in Cloud Computing** 5.1 Cloud Security Fundamentals 5.2 Cloud Risk 5.3 Cloud Risk division :Polity and Organizational Risks ,Technical Risks and Legal risks 5.4 Technologies for Data security, Data security risk 5.5 Digital identity and access management 5.6 Content level security 5.7 Security-As-A-Cloud Service **Course Outcome:CO5 Teaching Hours : 08 Marks: 10 (R- 04 , U-04 , A-02)**
6	**Cloud Computing at Work** 6.1 Cloud trends in supporting Ubiquitous Computing 6.2 Cloud Platforms: Amazon EC2 and S3,Microdsoft Azure , Cloud stack, Inter cloud, Google App Engine, Open Source cloud Eucalyptus, Open stack, Open Nebulla etc. 6.3 Future of Cloud-Based smart Devices, Faster time to Market for Software 6.4 Applications, Home Based Cloud Computing, Energy Aware Cloud Computing 6.5 Migrating to the Cloud : which application do you need?, Sending your existing data to cloud, Cost Saving . **Course Outcome:CO6 Teaching Hours : 08 Marks: 10 (R- 02 , U-04 , A-04)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Introduction to Cloud Computing**	4	4	2	10
2	**Virtualization**	4	4	2	10
3	**Storage in Cloud**	4	4	2	10
4	**Cloud Monitoring and Management**	4	4	2	10
5	**Security in Cloud Computing**	4	4	2	10
6	**Cloud Computing at Work**	2	4	4	10
	Total	24	**24**	**12**	**60**

List of experiments:Total 10-12 experiments(or turns) out of 15-16 experiments(or turns)

Sr. No.	Unit No	Cos	Title of the Experiments	Hours
1	1	CO1	Review of cloud computing and its architecture.	2
2	2	CO2	Creating Virtual Machines , installing Operating system and applications on Virtual Machine.	2
3	2	CO2	Deleting Virtual Machine and recreating it.	2
4	2	CO2	Create a VM image and create VM from captured image.	2
5	6	CO3	Create and document the process of creating a Microsoft Azure Account(or any other free)	2
6	6	CO3	Create a free Microsoft Azure(or any other free) account and explore its management console	2
7	3	CO4	Demonstrate and use Amazon EC2 or Google cloud for storage.	2
8	2	CO4	Installing web server (Apache Tomcat) on VM, hosting simple web application on it.	2
9	5	CO5	Case Study of Security as a Service	2
10	2	CO4	Implementation of Virtualization using VM Ware‘s Workstation or Oracle‘s Virtual Box and Guest O.S.	2
11	6	CO6	Case Study: PAAS(Facebook, Google App Engine)	2
12	6	CO6	Case Study: Amazon Web Services.	2
13	3	CO3	Study Current Technologies for Large Data Processing(Google-GFS, BigTable and MapReduce)	2
14	6	C06	Installation and Configuration of CloudSim.	2
15	6	CO6	Building Application on Cloud	2
			Total	**30**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Cloud Computing, Principals and Paradigms	Rajkumar Buyya, J.Broberg, A. Goscinski A John Wilwy & Sons, Inc.,	ISBN: 978-0-470-88799-8
2	Cloud Computing	Rishabh Sharma Wiley Publication	ISBN: 978-81-265-5306-8
3	Handbook of Cloud Computing	Springer Publication	ISBN: 978-1-4419-6524-0
4	Mastering Cloud Computing	Rajkumar Buyya. Christian Vecchiola, Tata McGraw Hill Publication	ISBN: 978-1-25-902995-0

E-References:

1. https://ndl.iitkgp.ac.in/
2. www. tutorialpoint.com
3. www.cloud.google.com
4. www.udemy.com

CO Vs PO and CO Vs PSO Mapping (Computer Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	3	3	2	3	3
CO2	2	2	3	3	1	3	2	2	3	2
CO3	2	3	3	2	2	2	2	2	2	2
CO4	2	3	2	3	2	3	3	2	3	3
CO5	1	2	3	3	2	3	3	2	3	3
CO6	2	2	3	3	2	3	3	2	3	3

CO Vs PO and CO Vs PSO Mapping (Information Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	3	3	2	3	3
CO2	2	2	3	3	1	3	2	2	3	2
CO3	2	3	3	2	2	2	2	2	2	2
CO4	2	3	2	3	2	3	3	2	3	3
CO5	1	2	3	3	2	3	3	2	3	3
CO6	2	2	3	3	2	3	3	2	3	3

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Ms.Pratibha Zunjare	Software Engineer	Proquest , USA.
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3	Mrs.Vachani Neha H.	Lecturer , Computer Engg	Govt. Polytechnic Mumbai
4	Mrs.Lokhande Vandana S.	Lecturer , Computer Engg	Govt. Polytechnic Mumbai

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Head of Department
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I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Computer Engineering (Sandwich Pattern)**										
Course Code: **CO19406**				Course Title: **Data Analytics using R**						
Compulsory / Optional: **Optional**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Mins)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	**2**	**-**	**5**	**60**	**20**	**20**	**25***	**--**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Data Analytics is the process of examining data sets in order to draw conclusions about the information they contain, with the aid of specialized system and software. This course introduces the most popular data analytics tool 'R'. The R language is widely used among statisticians and data miners for developing statistical software and for data analysis. 'R' is rapidly becoming a leading language in data science and statistics.

Course Outcomes: Student should be able to

CO1	Identify the job responsibilities in Data Science area.
CO2	Perform different operations on R data structures.
CO3	Import/Export data from/to various files, database.
CO4	Perform Graphical analysis of imported data.
CO5	Build relationship model of data using Regression techniques.
CO6	Implement Object Oriented features of R.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Data Science** 1.1 Data Science Basics 1.2 Introduction to Components of Data Science 1.2.1 Big Data 1.2.2 Data Mining 1.2.3 Data Analytics 1.2.4 Machine Learning

	1.3 Problem Solving steps in Data Science 1.3.1 Collecting data 1.3.2 Data Preparation 1.3.3 Model Planning 1.3.4 Model Building 1.3.5 Driving insights and generating reports 1.3.6 Taking decision based on insights 1.4 Tools for Data Science(List out only) 1.4.1 Data Analysis tools 1.4.2 Data Warehousing 1.4.3 Data Visualization tools 1.4.4 Machine Learning tools 1.5 Job roles in Data Science Industry 1.6 Applications of Data Science **Course Outcome: CO1 Teaching Hours : 04 Marks: 08 (R-04 , U-4 , A-)**
2	**R Programming Fundamentals** 2.1 Overview of R Language 2.2 Features of R 2.3 Basic Data Types and Operators in R 2.4 Data Structures in R • Vectors • Factors • Arrays • Matrices • Dataframes • List 2.5 Vectors 2.5.1 Properties of Vectors: type, length, attributes. 2.5.2 Working with Vectors • Creating and Deleting Vectors of different types using: seq( ), assign( ), Vector( ), rep( ), c( ), rm( ) functions • Sorting vector: sort( ) function • Dealing with NA (Not Available) values 2.5.3 Vector Indexing 2.5.4 Reading data using scan( ) function. 2.6 Factors 2.7 Arrays 2.7.1 Operations on Array and elements manipulation **Course Outcome: CO2 Teaching Hours : 11 Marks:14 (R-4, U-6, A-4)**
3	**Data Structures in R(Contd.)** 3.1 Matrices 3.1.1 Operations on Matrix and element manipulation • Creating Matrices

	• Properties of Matrix: str( ), dim( ), length( ) functions • Naming rows and columns in Matrix: rownames( ), colnames( ) • Accessing and replacing Matrix elements using index • Adding rows and columns in Matrix: rbind( ), cbind( ) • Matrix Arithmetic 3.2 Dataframes 3.2.1 Operations on Dataframe and element manipulation • Creating Dataframe • Extracting data from Dataframe • Data Reshaping: Adding rows and columns, Merge Dataframes, Melting and Casting of Dataframe. • Sorting Dataframe: order( ) function • Data Sampling. • Deleting data 3.3 List 3.3.1 Operations on List and Components manipulation • Creating List and Accessing List components • Inserting and deleting components to/from List 3.4 Date and time functions in R 3.5 Strings in R • Working with String using different string functions. 3.6 Control Structures in R 3.6.1 if-else 3.6.2 For loop 3.6.3 While loop 3.6.4 Repeat loop 3.6.5 Next, break 3.6.6 apply( ), sapply( ), lapply( ) functions **Course Outcome:CO2 Teaching Hours :13 Marks:16 (R-04,U-04,A-08)**
4	**Working with Data** 4.1 Functions in R 4.1.1 User Defined Function 4.1.2 Lazy evaluation of Function 4.2 Import and Export data to/from CSV file 4.3 Import and Export data to/from Excel file 4.4 Database connectivity via ODBC • Import data, perform different operation on it • Export data to database 4.5 Import XML file. • Convert XML file to Dataframe 4.6 Graphical data analysis 4.6.1 Simple Graph: plot( ) 4.6.2 Pie Chart

	4.6.3 Bar Chart 4.6.4 Histogram 4.6.5 Boxplot **Course Outcome:CO3,CO4 Teaching Hours :11 Marks:12 (R-2 ,U-04,A-06)**
5	**Advanced R programming** 5.1 Mean, Mode, Median 5.2 Regression 5.2.1 Linear Regression 5.2.2 Multiple Regression 5.3 Object oriented programming in R 5.3.1 S3 and S4 classes. • Creating classes and objects. • Implementing object oriented feature like Inheritence. **Course Outcome: CO5,CO6 Teaching Hours :06 Marks:10 (R-, U-04,A-06)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Introduction to Data Science**	04	04	-	08
2	**R Programming Fundamentals**	04	06	04	14
3	**Data Structures in R(Contd.)**	04	04	08	16
4	**Working with Data**	02	04	06	12
5	**Advanced R programming**	-	04	06	10
	Total	**14**	**22**	**24**	**60**

List of experiments: Total 10-12 experiments (or turns) out of 15-16 experiments (or turns)

Sr. No.	Unit No	Cos	Title of the Experiments	Hours
1	1	CO1	1.1 Installation of R and R-Studio. 1.2 Setting up R environment	02
2	2	CO2	2.1 Create Vectors using different functions. 2.2 R as calculator: Perform various mathematical operations on Vectors 2.3 Write R function to create 2 dimensional 4x3 Array of sequence of even integers greater than 40.	04
3	4	CO3	Develop R script to import/export data from/to:	04

			3.1 CSV file and perform various operations on it. 3.2 EXCEL file and perform various operations on it.	
4	4	CO4	Draw simple graph using plot( ) function for a Vector. Use different parameters of plot( ) to add elements in graph.	02
5	5	CO5	Write R script to build: 5.1 Linear regression model. 5.2 Multiple regression model.	02
6	5	CO6	Develop R script to create S3 class, objects and functions.	02
7	2	CO2	Write R script to: 7.1 Find row and column index of maximum and minimum value in a given Matrix. 7.2 Perform Inner, Outer, Left and Right join operations on two Dataframes.	04
8	4	CO3	Write R script to: 8.1 Generate multiplication table for user entered number. 8.2 Create simple calculator using switch control structure.	02
9	4	CO4	Draw pie chart, Bar Chart and Histogram for any of the built-in datasets.	02
10	5	CO6	Develop R script create S4 class, objects and functions.	02
11	5	CO2	Write R script to: 11.1 Find the length of first two components in List. 11.2 To convert matrix into list.	02
12	5	CO3	Develop R script to connect to the database. Import data from database, manipulate it and export it to database.	02
Total				**30**

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	R for beginners	Sandip Rakshit, McGraw Hill, 1st Edition-2017	9789352604555
2	R for Data Analysis	Mike McGrath	
3	R For Dummies	Andrie de Vries, Joris Meys, John Wiley & Sons, Inc. 2nd Edition-2015	978-1-119-05585-3 (epdf)

E-References:

1. http://adv-r.had.co.nz
2. www.statisticsglobe.com
3. www.studytrails.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**3**
CO2	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**2**	**3**	**1**	**1**	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**3**	**2**	**3**
CO6	**2**	**2**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Samit Kumar	Senior Project Associate	Cognizant Technology Solutions, Pune
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3	Mrs. Vrushali Ashok Patil (Curriculum Content Designer)	Lecturer in Computer Engineering	Govt. Polytechnic Mumbai

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Department of Computer Engineering

Head of Department
Department of Computer Engineering

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Information Technology and Computer Engineering (Sandwich Pattern)**										
Course Code:**IT19304**				Course Title: **Microcontroller and Embedded system**						
Compulsory / Optional: **Compulsory for IT and Optional for CO**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	**2**	**--**	**5**	**60**	**20**	**20**	**25***	**---**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

Microcontroller is heart of all domestic, industrial, consumer goods and other high end products. Automation in every field of life is being used and microcontroller is inbuilt element of these systems and devices. 8051 microcontroller architecture, peripheral interfacing to it and assembly language programming is covered in this course. Microcontroller is inbuilt element of embedded system. This course will also cover the concepts of embedded system. It covers Arduino and its programming.

Course Outcomes: Student should be able to

CO1	Comprehend the architecture and signal description of 8051.
CO2	Develop the program for 8051 for the given operations.
CO3	Interpret the program by using timer, interrupt and serial port/parallel port.
CO4	Interface various input and output devices to microcontroller.
CO5	Comprehend the concept of embedded systems, aurdino and its programming.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Basics of Microcontroller 8051:** 1.1 General architecture of Microcontroller 1.2 Comparison of Microprocessor and Microcontroller 1.3 Architecture of 8051 1.4 Pin configuration and signal description of 8051 1.5 Memory Organization of 8051 1.6 Special features of 8051- Boolean Processor, Power saving options- idle and power

	down mode, Derivatives of 8051(8951, 8952, 8031, 8751). **Course Outcome: CO1 Teaching Hours :8hrs Marks: 10 (R- 4, U-6, A-0)**
2	**8051 Instruction set and Programming** 2.1 Instruction set (Data transfer, Aritmatic and Logical, Branching, Machine control, stack operation, Boolean) 2.2 Addressing modes 2.3 Assembly language programming 2.4 8051 programming in C **Course Outcome: CO2 Teaching Hours :10hrs Marks: 14 (R- 0, U-0, A-14)**
3	**Timer, Interrupts, Serial and Parallel communicaion** 3.1 8051 Timer/Counter: Logic and Modes, Programming of 8051 timer 3.2 8051 Interrupts: Interrupts and polling, SFRs- IE, IP, Priority level and interrupt sequence 3.3 Serial Communication: SCON, SBUF, Modes of serial communication, Programs on serial communication 3.4 Parallel communication: I/O port structure and its programming **Course Outcome: CO3 Teaching Hours :8hrs Marks: 8 (R- 0, U-4, A-4)**
4	**Memory and I/O Interfacing** 4.1 Memory Interfacing: Interfacing of external program and data memory, Address map table 4.2 I/O Interfacing: Interfacing of LEDs, Relays, Keyboard, Seven segment display, LCD, Stepper motor, DC motor, ADC 0808, DAC 0808 4.3 Applications of 8051 Square wave generation using port pins of 8051 Triangular wave generation using DAC Water level controller Temperature controller using ADC Stepper motor control for clockwise and anticlockwise rotation Traffic light controller Programming can be in assembly language or C (student's choice) **Course Outcome: CO4 Teaching Hours :10hrs Marks: 14 (R- 0, U-0, A-14)**

5	**Introduction to embedded systems** 5.1 Block diagram of embedded system with hardware components. 5.2 Harvard and Von Neumann architecture, RISC and CISC processors 5.3 Characteristics of embedded system, Processor power, memory, operating system, reliability, performance, power consumption, unit cost size, flexibility, 5.4 Classification of embedded system **Course Outcome: CO5 Teaching Hours :4hrs Marks: 4 (R- 2, U-2, A-0)**
6	**Open source embedded devlopment board (Arduino)** 6.1 Arduino Birth, Open source community 6.2 Functional block diagram of Arduino 6.3 Functions of each pin of Arduino 6.4 I/O functions,Looping techniques, Decision making techniques. 6.5 Programming of an Arduino Interfacing LEDs, Seven segment display, LCD, ADC, DAC, Stepper motor, DC Motor. Various applications using Arduino. **Course Outcome: CO5 Teaching Hours :5hrs Marks: 10 (R- 0, U-4, A-6)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Basics of Microcontroller 8051**	4	6	0	10
2	**8051 Instruction set and programming**	0	0	14	14
3	**Timer, Interrupts, Serial and Parallel communication**	0	4	4	08
4	**Memory and I/O interfacing**	0	0	14	14
5	**Introduction to Embedded systems**	2	2	0	04
6	**Open source embedded development board (arduino)**	0	4	6	10
	Total	**06**	**16**	**38**	**60**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of experiments: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Identify various blocks of 8051 microcontroller development board	02
2	2	CO2	Write an assembly language program to perform arithmetic operations such as addition, subtraction, multiplication and division	02
3	2	CO2	Write an ALP to find smallest/largest numbers from the given data bytes stored in internal/external data memory locations	02
4	2	CO2	Write an ALP to arrange numbers in ascending/descending order. Write a C program for the same task.	02
5	3,4	CO3 CO4	Interface LED with microcontroller and turn it ON for 1 sec. Write program either in C or assembly language.	02
6	3	CO3	Develop an ALP to generate pulse and square wave by using timer delay.	02
7	4	CO4	Interface 7 segment display to 8051 and display numbers 0 to 9 on it.	02
8	4	CO4	Interface 4X4 keyboard matrix with 8051 and display the key pressed on 7 segment display	02
9	4	CO4	Interface stepper motor to 8051 and write a program to rotate in clockwise and anticlockwise direction for given angles.	02
10	6	CO5CO6	Control the speed of DC motor using Arduino.	02
11	6	CO5CO6	Implement line follower robot using Arduino.	02
12	6	CO5CO6	Implement water level controller using Arduino	02
13	6	CO5CO6	Implement Digital Thermometer using Arduino	02
14	6	CO5CO6	Interface 4x4 keyboard matrix and 16x2 LCD to Arduino	02
15	6	CO4CO5	Interface DAC to 8051 and write ALP to generate square and triangular waveforms.	02

Note: Experiments No. 1, 3, 6, 11, 12 and 15 are compulsory. Remaining 4 experiments should be performedas per the importance of the topic.

References/ Books:

Sr. No.	Book Title	Author, Publisher, Edition and Year Of publication	ISBN
1	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	Mazidi, Pearson Education India; 2 edition 2007	978-8131710265
2	The 8051 Microcontroller & Embedded Systems Using Assembly and C with CD	Kenneth Ayala, Delmar Cengage Learning; First edition , January 2010	978-8131511053
3	Introduction to Embedded System	Shibu K. V., MC Graw Hill, First edition, 2009	978-1259081514
4	Beginning Arduino	Michael McRoberts, Technology in action, First edition 2010	978-1430232414
5	Programming Arduino Getting started with sketches	Simon monk, MC Graw Hill, First edition, 2012	978-0071784238

E-References:

1. www.tutorialspoint.com/microprocessor/microcontrollers_8051_architecture.htm
2. www.elprocus.com/8051-microcontroller-architecture-and-applications/
3. www.javatpoint.com/embedded-system-8051-microcontroller-architecture
4. http://index-of.es/Varios-2/Programming%20Arduino.pdf
5. http://www.digimat.in/nptel/courses/video/108105102/L31.html
6. https://www.arduino.cc/en/Tutorial/BuiltInExamples

CO Vs PO and CO Vs PSO Mapping (Information Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3							1		
CO2	3	2	3	3	3			3		
CO3	3	3	3	3	3		3			1
CO4	3	2	3	3	3		3	3	1	2
CO5	3	3	3	3	3	3	3	3	1	2

CO Vs PO and CO Vs PSO Mapping (Computer Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3							2	2	
CO2	3	2	3	3	3			2	3	
CO3	3	3	3	3	3		3	2	2	1
CO4	3	2	3	3	3		3	1	3	2
CO5	3	3	3	3	3	3	3	2	2	1

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Principal

GOVERNMENT POLYTECHNIC MUMBAI GPM ESTD. 1960 MAKING KNOWLEDGE TO WORK

Programme : Diploma in Information Technology and Computer Engineering (Sandwich Pattern)										
Course Code: **IT19501**				Course Title: **Entrepreneurship and Start-ups**						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH	TS1	TS2	PR	OR	TW	Total
--	**2**	--	**2**	--	--	--	--	**25***	**25**	**50**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale: Entrepreneurs are often thought of as national assets to be refined, motivated and remunerated to the greatest possible extent. Entrepreneurs can change the way we live and work. If successful, their revolutions may improve our standard of living. In short, in addition to creating wealth from their entrepreneurial ventures, they also create jobs and the conditions for a flourishing society. This course will try to inculcate the values of Entrepreneurship and Start up among the students.

Course Outcomes: Student should be able to

CO1	Understand the dynamic role of entrepreneurship and small businesses.
CO2	Create business ideas / opportunities
CO3	Explain Financial Planning and Control
CO4	Illustrate Break Even Analysis
CO5	Choose Marketing Strategy
CO6	Explain New Product or Service development

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Management** 1.1 Introduction to Management, organisation structure 1.2 Difference between Management & Administration 1.3 Concept of Scientific Management 1.4 Functions of management 1.5 Introduction to Human Resource Management 1.6 Staffing, training & induction to staff.
2	**Financial & Project Management** 2.1 Importance of financial management 2.2 Financial organization and management 2.3 Budgets & their analysis 2.4 Project management 2.5 CPM ,PERT analysis & application 2.6 Break even analysis, KAIZEN ,6S.
3	**Introduction to Entrepreneurship** 3.1 Definitions, Traits of an entrepreneur, Entrepreneurship, Motivation 3.2 Types of Business Structures, differences between entrepreneur & manager 3.3 Business Ideas and their implementation 3.4 Discovering ideas and visualizing the business 3.5 Activity map 3.6 Business Plan 3.7 Double Diamond Approach
4	**Start ups** 4.1 Introduction, Idea to Start-up 4.2 Market Analysis – Identifying the target market, 4.3 Competition evaluation and Strategy Development, 4.4 Marketing and accounting, 4.5 Risk analysis
5	**Planning for Startup** 5.1 Financing and Protection of Ideas 5.2 Financing methods available for start-ups in India 5.3 Communication of Ideas to potential investors – Investor Pitch 5.4 Patenting and Licenses
6	**Strategies for Entrepreneurs** 6.1 Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy

Tutorial/Assignment:

Note: All assignments are compulsory

Sr. No.	Unit No	COs	Title of tutorial/assignment	Hours
1	1	CO1	Interactive session with an Entrepreneur	02
2	2	CO2	Brain storming of ideas for start-up in current scenario	04
3	3	CO2	Identification of business opportunity	04
4	4	CO3	Financing the start up	04
5	4	CO3	Running the startup	04
6	4	CO4	Break even analysis	04
7	4	CO5	Marketing strategy	04
8	4	CO6	Preparing project report	06
Total				**32**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf, K & S Ranch Publication	978-0984999392
2	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries, Penguin UK	978-0670921607
3	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber, Headline Book Publishing	978-0755388974
4	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Christensen, Harvard business	978-142219602

E-References:

1. https://www.fundable.com/learn/resources/guides/startup

2 .https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/

3. https://www.finder.com/small-business-finance-tips

4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

CO Vs PO and CO Vs PSO Mapping (Information Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	--	--	3	3	3	3	2	--	--	3
CO2	--	--	3	3	3	3	2	--	--	3
CO3	--	--	3	3	3	3	2	--	--	3
CO4	--	--	3	3	3	3	2	--	--	3
CO5	--	--	3	3	3	3	2	--	--	3
CO6	--	--	3	3	3	3	2	--	--	3

CO Vs PO and CO Vs PSO Mapping (Computer Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	--	--	3	3	3	3	2	--	--	3
CO2	--	--	3	3	3	3	2	--	--	3
CO3	--	--	3	3	3	3	2	--	--	3
CO4	--	--	3	3	3	3	2	--	--	3
CO5	--	--	3	3	3	3	2	--	--	3
CO6	--	--	3	3	3	3	2	--	--	3

Industry Consultation Committee:

Sr. No	**Name**	**Designation**	**Institute/Organisation**
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2	Mr.Santosh Bhosale	Software Engineer	TCS, Mumbai
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