MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

FACULTY OF ENGINEERING AND TECHNOLOGY

CURRICULUM

AND

SCHEME OF EXAMINATION

B.TECH- ELECTRONICS & COMMUNICATION ENGINEERING

BATCH: 2022-2026

FOREWORD

This is to certify that this booklet contains the entire Curriculum and Scheme of Examination of B.Tech-Electronics and Communication Engineering being offered at Faculty of Engineering and Technology of this University. This has been duly vetted and finally approved by the Academic Council of the University vide 37th **Academic Council** held on 2nd July, 2021 and changes, if any deemed appropriate, shall be duly incorporated after the necessary approval by the Academic Council.

This Curriculum and Scheme of Examination of B.Tech Electronics and Communication Engineering shall be implemented w.e.f. AY 2022-23.

Prof. (Dr.) Naresh Grover

Date: **Dean-Academics, MRIIRS**

PREAMBLE

The Electronics and Communication Engineering Department was set up in 1997 and aims to encourage research and innovation in a wide area of applied and fundamental aspects of Electronics and Communication Engineering. The objective of the B Tech program in Electronics and Communications Engineering (ECE) is to prepare students to undertake careers involving innovation and connect knowledge of core and interdisciplinary domains for problem solving using suitable techniques and hardware and software technologies, or to undertake their progressive career in advanced research fields. In order to give due importance to practical as well as theoretical aspects of Electronics & Communication Engineering, the curriculum for the B.Tech (ECE) program covers most of the basic aspects and also develops in students the engineering skills for real world problem solving. Besides being better suited for developing engineering capabilities, it also enables the possibility of students seeing newer applications and possibilities of using computing and electronics in these subjects. The first year of the ECE program is common with other branches of engineering which provides flexibility to students to get acquainted with other domains of engineering. The second-year program is relatively fixed, comprising mostly core courses for the program. Third year onwards the program can be mostly flexible, comprising of various kinds of electives to get the students acquainted with vast knowledge of their own interest. The curriculum includes the solutions to deal with gender related and environment related issues in the society. The program also incorporates several courses having relevance to the Local/Regional, National and Global Development needs like Programming for Problem Solving, Internet of Things, Communication Engineering, Digital Signal Processing, Microwave Theory and Techniques etc. As an integral part of society, it is our responsibility to take care of the Environment as well, which is possible by having an in-depth knowledge of some specific areas. This has been made possible by including some courses like Environmental Sciences and Professional Ethics into the Curriculum in order to give the students of ECE an overall holistic approach towards Society and the Environment. Other courses like Professional Communication, Holistic Wellness and Life Skills help the student to develop into a responsible member of society with inherent ethical and moral values, who can contribute to the prevalence of science and technology at global level.

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To impart latest knowledge and skills so as to kindle innovation & creativity among students, to develop and sustain a culture of research while promoting values, ethics and responsible professionalism, leading to a progressive career in industry & academia globally.

MISSION

- To engage modern education aids, laboratories and competent faculty ensuring effective teaching learning process to meet the ever growing and changing industrial and business environment.
- To continuously challenge the young minds with ideas so as to carry out innovative research through interaction with the research organizations & industry and to provide them avenues for recognition by participation in challenging platforms.
- To develop responsible citizens and professional leaders with high ethical and moral values, who contribute in dissemination of universal science and technology.

ABOUT THE DEPARTMENT

The Electronics and Communication Engineering Department was set up in 1997 and its B.Tech in ECE programme was accredited by NBA thrice, in 2004, 2007 and 2018. The Department has a rich tradition in research and teaching. The research interests of the faculty members of the department encompass the wide area of applied and fundamental aspects of Electronics and Communication Engineering including but not limited to Communication Systems, Microelectronics & VLSI, Digital Signal Processing, Wireless and Mobile communication, Antenna Design and RF & Microwave Engineering. A large number of Ph.D. scholars are currently engaged in cutting edge research in the Department.

The Department has modern, well equipped laboratories with adequate facilities catering to the requirements of undergraduates, postgraduates and research scholars particularly in the area of High End Electronic Design, Microcontrollers, Microprocessors, Embedded System Design, VLSI Design, Antenna Design, Microwave, Advanced Communication Systems, Simulation and Digital Signal Processing. In addition to the well-equipped curriculum related laboratories, the Department has strong association with the Research Clusters and various Centers of Excellence in the University.

The Department continuously upgrades the curriculum and teaching inputs taking cognizance of its prime stake holders viz. research organizations, industry, peer community, alumni, parents and students. To give greater emphasis on education methodology, guest lectures, seminars, workshops, personality development programs, educational tours, industrial visits and quizzes are organized. The department has linkages with industry, leading academic institutes and scientific research organizations like the DST, MoSPI, DRDO, IIT, ISI, SAP, RIL etc. The department has offered consultancy to various industries. The student chapter of Institution of Engineers India (IEI) and ISTE is fully functional in the department.

The Department also has the following Knowledge Partners:

- INTEL Internet of Things (IOT) is a centre for higher education program for conducting FDPs, Events, Workshops on GALILEO and EDISON platform.
- ATMEL India University program for sponsoring labs and organizing FDPs, events, workshops on ATMEGA 168PB and SAM D21 Microcontrollers.
- Texas Instruments (TI) India University Program (Edgate Technologies) forrunning Teaching Lab Facility
- National Kaohsiung University of Applied Science (KUAS) Taiwan- A student exchange program where-in the selected students shall be provided fully paid two years academic and industrial exposure.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The Department of Electronics and Communication Engineering keeping in view interests of all their stakeholders have formulated the Program Educational Objectives (PEO's) that are comprehensive statements describing the career and professional accomplishments that the program is preparing the learner for.

PEO's of B.Tech Program in Electronics and Communication Engineering are:

PEO 1: To prepare Graduates with sound foundation in fundamentals of basic sciences and to assist them exhibit strong, independent learning, analytical &problem solving skills in Electronics and Communication Engineering domain.

PEO 2: To facilitate learning in the core field of Electronics and Communication Engineering so as to integrate technological progression and software & firmware skills to produce high impact, energy efficient and futuristic solutions.

PEO 3: To prepare Graduates to effectively use modern equipment and programming tools to solve real life multi-disciplinary problems that are technically sound, economically feasible and socially acceptable.

PEO 4: To assist and enable individuals acquire skills to imbibe life-long learning in the field of Electronics and Communication, related research & innovation so as to have progressive careers as Managers or Entrepreneurs.

PEO 5: To inculcate professional and ethical attitude, team spirit, leadership qualities and effective communication skills in Graduates and to make them aware of their social responsibilities.

"Mission of the Department – PEOs matrix"

PEO Statements		Mission 1	Mission 2	Mission 3
PEO1:	To prepare Graduates with sound foundation in fundamentals of basic sciences and to assist them exhibit strong, independent learning, analytical &problem solving skills in Electronics and Communication Engineering domain.	**3**	**3**	**2**
PEO2:	To facilitate learning in the core field of Electronics and Communication Engineering so as to integrate technological progression and software & firmware skills to produce high impact, energy efficient and futuristic solutions.	**3**	**3**	**2**
PEO3:	To prepare Graduates to effectively use modern equipment and programming tools to solve real life multi-disciplinary problems that are technically sound, economically feasible and socially acceptable.	**3**	**3**	**2**
PEO4:	To assist and enable individuals acquire skills to imbibe life-long learning in the field of Electronics and Communication,	**3**	**3**	**2**

	related research & innovation so as to have progressive careers as Managers or Entrepreneurs.			
PEO5:	To inculcate professional and ethical attitude, team spirit, leadership qualities and effective communication skills in Graduates and to make them aware of their social responsibilities.	**2**	**2**	**3**

PROGRAM OUTCOMES (POs) / PROGRAM SPECIFIC OUTCOMES (PSOs)

Program Outcomes / Program Specific Outcomes describe graduate attributes i.e. what students are expected to know or will be able to do when they graduate from a program. The POs / PSOs of B. Tech. in Electronics & Communication Engineering are:

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and Engineering specialization to the solution of complex engineering problems.

PO2: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO10: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO11: Demonstrate knowledge and understanding of engineering and management principles and apply these to one’s own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1: Connect learning from Core and Disciplinary/Interdisciplinary elective courses of Electronics and Communication Engineering to assimilate technological advancements in the fieldfor analyzing and designing subsystem processes to arrive at the solution to real world problems.

PSO2: Acquire hardware and software skills pertinent to research and industry practices in the field of Electronics & Communications while acquiring soft skills like persistence, proper judgment through projects and industrial interactions.

PSO3: Ability to identify indigenous processes and components for producing high quality, compact, energy efficient and eco-friendly solutions at affordable prices for existing and new applications directly and indirectly related to Electronics & Communication industry.

PSO4: Focus on acquiring right blend of aptitude and attitude so as to be the candidate of first choice for placements and higher education or to become a successful Entrepreneur and a worthy global citizen.

The department has always striven to maintain its high standards by revising academic syllabi to suit the industrial requirements. Foundation Courses, Core Courses and Elective Courses (Generic, Discipline and Open) shall be offered during B.Tech in Electronics & Communication Engineering to the Student for his overall grooming in the field of Electronics and Communication.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES TO PROGRAM OUTCOMES

POs / PEOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
PEO 1	3	3	2	2	1	1	1	-	-	-	-	1	1	2	1	-
PEO 2	3	3	3	2	2	1	1	-	-	-	-	1	3	3	2	-
PEO 3	-	-	1	1	1	2	2	-	-	-	-	3	2	3	3	1
PEO 4	1	1	2	3	3	2	2	-	-	-	-	2	2	-	3	3
PEO 5	-	-	1	-	1	1	2	3	3	3	3	1	-	3	2	3

SEMESTER AND CHOICE BASED CREDIT SYSTEM

Credit based system of study and student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grade obtained by the student, grade point average is calculated.

(a) Course credits assignment

Each course has a certain number of credits assigned to it depending upon its duration in periods for lecture, tutorial and laboratory/clinical practice in a week. A few courses/activities are without credit (s) and are referred to as Audit Pass Courses (APC) but are mandatory to pass as a partial fulfillment of award of degree.

(b)Earning of credits

At the end of every course, a letter "Grade" shall be awarded in each course for which a student has registered. On obtaining a minimum Pass Grade, student shall accumulate the course credits as Earned Credits. A student's performance shall be measured by the number of credits that he/she has earned and by the weighted grade point average. Grades obtained in the audit courses shall not be counted for computation of grade point average, however shall be mandatory to pass as a partial fulfillment of award of degree.

For Award of Degree of B.Tech Electronics and Communication Engineering, he/she has to earn minimum 160 credits during the 4 year duration of the programme in 8 semesters.

The total credits required to be earned have been further classified under two baskets of courses: "Compulsory Courses Basket", and "Elective Courses Basket". The total 126 credits required to be earned under "Compulsory Courses Basket" and 34 credits under "Elective Courses Basket". To attain an honours /specialization degree an additional credits of 18-20 can be earned during 4 year duration.

All courses under "Compulsory Courses Basket", are required to be qualified and cleared/pass by each and every students enrolled under the programme and are semester-wise listed in the study scheme along with credits assigned to each course.

Under Elective Courses Basket, there will be three types of courses:

- Semester-wise courses offered by the department itself
- Open/Inter-disciplinary courses offered at the Institute/University level notified from the office of Dean-Academics.
- Massive Open Online Courses (MOOCs) available on SWAYAM Platform or any other platform as recommended by UGC/AICTE and notified from the office of Dean-Academics.

Each course shall have credits assigned to it. Student shall be required to register courses every semester for as many courses/credits specified under "Elective Courses Basket" depending upon his/her interest, capability/pace of learning and availability of time slot (without any clash in time table) so as to earn all required total credits under the "Elective Courses Basket" during the entire programme duration.

However, for registration of courses [including courses under "Compulsory Courses Basket", "Elective Courses Basket" and Previous Semester Courses (wherein he/she was declared in-eligible on the basis of attendance or he/she could not clear the course within permissible given chances)], if any, the maximum limit in a semester shall be 28 credits.

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
FACULTY OF ENGINEERING & TECHNOLOGY
STUDY SCHEME FOR B.TECH ECE (2022-26 BATCH)
SEMESTER-I

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Type	Course Code	Title of Course	Pre-requisite Course, if any		Periods/Week				Marks			Duration of Exam	Credits
			Title	Code	L	T	P	Total	Int	Ext	Total		
Compulsory Courses													
BSC	BPH-106	Physics for Engineers	NA	NA	3+1#	0	0	4	100	100	200	3 hrs	3
BSC	BMA-102	Mathematics- 1	NA	NA	3+1#	1	0	5	100	100	200	3 hrs	4
ESC	BEE-101A	Basic Electrical Engineering	NA	NA	3	0	0	3	100	100	200	3 hrs	3
ESC	BME-101A	Engg Graphics & Design	NA	NA	0	0	4	4	100	100	200	3 hrs	2
BSC	BPH-151A	Physics lab	NA	NA	0	0	2	2	50	50	100	2 hrs	1
ESC	BEE-151A	Basic Electrical Engg lab	NA	NA	0	0	2	2	50	50	100	2 hrs	1
ESC	BCS-100A	Artificial Intelligence for Engineers	NA	NA	2	0	0	2	100	100	200	3 hrs	2
HSMC	BHM-101	English	NA	NA	2	0	0	2	50	50	100	2 hrs	2
HSMC	BHM-MC-001	Constitution of India	NA	NA	1	0	0	1	50	50	100	2 hrs	AP
		Total			**16**	**1**	**8**	**25**	**700**	**700**	**1400**		**18**

 # NOTE: Contact hours per week have been increased due to bridge course.

Elective Courses *

*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**

SEMESTER-II

Course Type	Subject Code	Subject	Pre-requisite Course, if		Periods/Week				Marks			Duration of Exam	Credits
			Title	Code	L	T	P	Total	Int	Ext	Total		
Compulsory Courses													
BSC	BCH-106	Chemistry for Engineers	NA	NA	2+1#	0	0	3	100	100	200	3 hrs	2
BSC	BMA-202	Mathematics- 2	NA	NA	3	1	0	4	100	100	200	3 hrs	4
ESC(C)	BME- 102	Workshop/Manufacturing Practices	NA	NA	0	0	4	4	100	100	200	3 hrs	2
BSC	BBT-100	Biology for Engineers	NA	NA	2	0	0	2	50	50	100	2 hrs	2
BSC	BCH-151A	Chemistry lab	NA	NA	0	0	2	2	50	50	100	2 hrs	1
HSMC	BHM-151	English lab	NA	NA	0	0	2	2	50	50	100	2 hrs	1
HSMC	BCH-MC-002	Environmental Science (EVS)	NA	NA	0	1	0	1	50	50	100	2 hrs	AP
ESC(C)	BCS-101A	Programming for Problem Solving	NA	NA	3	0	0	3	100	100	200	3 hrs	3
ESC	BCS-151A	Programming for Problem Solving lab	NA	NA	0	0	2	2	50	50	100	2 hrs	1
		Total			**11**	**2**	**10**	**23**	**650**	**650**	**1300**		**16**

***Training undertaken by students during the Summer vacation after second Semester(2 weeks minimum) will be evaluated as a III Semester course: (Proj-EC-300A), Students with specialization have to undergo compulsorily a course in C++ for 2 weeks in their training.**

 # NOTE: Contact hours per week have been increased due to bridge course.

Elective Courses *

*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**

Semester-III													
Course Type	**Course Code**	**Title of Course**	**Pre-requisite Course, if**		**Periods/Week**				**Marks**			**Duration of Exam**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Int**	**Ext**	**Total**		
Compulsory Courses													
CORE	BEC-DS-301A	Electronic Devices	Physics	BPH-104	3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-302	Digital Electronics	NA		3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-303A	Signals & Systems			3	0	0	3	100	100	200	3 hrs	3
Core	BCS-DS-301	Data Structure & Algorithms	NA		3	1	0	4	100	100	200	3 hrs	4
Core	BEE-DS-301	Electrical Circuit & Analysis	NA	BEE-101	3	1	0	4	100	100	200	3 hrs	4
HSMC	BHM-001A	Cyber Law & Ethics	NA		3	0	0	2	100	100	200	3 hrs	2
CORE	BEC-DS-351	Electronic Devices Lab	Electronic Devices	BEC-DS-301	0	0	2	2	50	50	100	2 hrs	1
CORE	BEC-DS-352	Digital Electronics Lab	Digital Electronics	BEC-DS-302	0	0	2	2	50	50	100	2 hrs	1
Core	BCS-DS-351	Data Structure & Algorithms Lab	Data Structure & Algorithms	BCS-DS-301	0	0	2	2	50	50	100	2 hrs	1
HSMC	DTI-300	Design Thinking and Innovation-I	NA		0	0	1	1	50		50	2 hrs	1
HSMC	BHM-MC-004	Quantitative Aptitude	NA		0	0	2	2	50	50	100	2 hrs	AP
PROJ	Proj-EC-300A*	Summer Internship-I	NA		2 weeks				50		50	2 hrs	1
Total					**18**	**0**	**9**	**26**	**900**	**800**	**1700**		**24**
#NOTE: Students of B.Tech Electronics and Communication Engineering with specialization in AI and IoT in collaboration with Intel will study the following: 1) IoT Design with Arduino and its corresponding Lab													
B.Tech (Hons) Electronics and Communication Engineering with specialization in Artificial Intelligence and Internet of Things in collaboration with Intel Corporation (2021-2025 Batch)													
CORE	**BEC-DS-201**	*** IoT Design with Arduino**	**NA**	**NA**	**3**	**0**	**0**	**3**	**100**	**100**	**200**	**3 hrs**	**3**
CORE	**BEC-DS-251**	*** IoT Design with Arduino Lab**	**IoT Design with Arduino**	**BEC-DS-201**	**0**	**0**	**2**	**2**	**50**	**50**	**100**	**2 hrs**	**1**
Total					**21**	**0**	**11**	**31**	**1050**	**950**	**2000**		**28**
Elective Courses *													
*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**													

SEMESTER-IV													
Course Type	**Course Code**	**Title of Course**	**Pre-requisite Course, if**		**Periods/Week**				**Marks**			**Duration of Exam**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Int**	**Ext**	**Total**		
Compulsory Courses													
CORE	BEC-DS-401A	Communication Engineering	NA		3	1	0	4	100	100	200	3 hrs	4
CORE	BEC-DS-402	Analog Circuits	Electronic Devices	BEC-DS-301	3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-403	Microprocessors & Microcontrollers	Digital Electronics	BEC-DS-302	3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-404A	Electromagnetic Waves	Physics	BPH-104	3	0	0	3	100	100	200	3 hrs	3
CORE	BCS-DS-302A	Object Oriented Programming	NA		3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-451	Communication Engineering Lab	Communication Engineering	BEC-DS-401	0	0	2	2	50	50	100	2 hrs	1
CORE	BEC-DS-452	Analog Circuits Lab	Analog Circuits	BEC-DS-402	0	0	2	2	50	50	100	2 hrs	1
HSMC	BHM-320	Universal Human Values: 2	NA		1	1	0	2	50	50	100	2 hrs	2
HSMC	BHM-MC-002	Sports and Yoga	NA		2	0	0	0	100		100	2 hrs	AP
CORE	BEC-DS-453	Microprocessors & Microcontrollers Lab	Microprocessors & Microcontrollers	BEC-DS-403	0	0	2	2	50	50	100	2 hrs	1
HSMC	DTI-400	Design Thinking and Innovation-II	NA		0	0	1	1	50		50	2 hrs	1
HSMC	BHM-MC-006	QAPD-I			0	0	2	2	50	50	100	2 hrs	AP
Total					**18**	**2**	**9**	**27**	**900**	**750**	**1650**		**22**
#NOTE: Students of B.Tech Electronics and Communication Engineering with specialization in AI and IoT in collaboration with Intel will study the following: 1) Python Programming and Raspberry Pi Fundamentals and its Lab in place of Object Oriented Programming													
B.Tech (Hons) Electronics and Communication Engineering with specialization in Artificial Intelligence and Internet of Things in collaboration with Intel Corporation (2021-2025 Batch)													
CORE	**BEC-DS-304**	*** Python Programming and Raspberry Pi Fundamentals**	**NA**		**3**	**0**	**0**	**3**	**100**	**100**	**200**	**3 hrs**	**3**
CORE	**BEC-DS-354**	*** Python Programming and Raspberry Pi Fundamentals Lab**	**Python Programming and Raspberry Pi Fundamentals**	**7**	**0**	**0**	**2**	**2**	**50**	**50**	**100**	**2 hrs**	**1**
Total					**15**	**0**	**11**	**27**	**900**	**850**	**1750**		**23**
Elective Courses *													
*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**													
***Training undertaken by students during the Summer vacation after Fourth Semester(4 weeks minimum) will be evaluated as a V Semester subject.**													

SEMESTER-V														
Course Type	**Course Code**	**Title of Course**	**Pre-requisite Course, if**		**Periods/Week**				**Marks**			**Duration of Exam**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Int**	**Ext**	**Total**		
Compulsory Courses													
Core	BEC-DS-503A	Antennas	NA		3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-501A	Digital Signal Processing and its Applications	NA		3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-508	Probability and Stochastic Processes	NA		3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-551A	Digital Signal Processing and its Applications Lab	Digital Signal Processing	BEC-DS-501A	0	0	2	2	50	50	100	2 hrs	1
PROJ	Proj-EC-500*	Summer Internship-II	NA		4 weeks				50		50	2 hrs	2
HSMC	BHM-520	Entrepreneurship and Startups	NA		2	0	0	2	100	100	200	2 hrs	2
HSMC	DTI-500	Design Thinking and Innovation-III	NA		0	0	1	1	50		50	2 hrs	2
HSMC	BHM-MC-008	QAPD-II	NA		0	0	2	2	50	50	100	2 hrs	AP
Total					**9**	**0**	**5**	**14**	**500**	**400**	**900**		**16**
#NOTE: Students of B.Tech Electronics and Communication Engineering with specialization in AI and IoT in collaboration with Intel will study the following: 1)Artificial Intelligence and its Lab													
B.Tech (Hons) Electronics and Communication Engineering with specialization in Artificial Intelligence and Internet of Things in collaboration with Intel Corporation (2021-2025 Batch)													
CORE	**BEC-DS-406**	*** Artificial Intelligence**	**NA**		**3**	**0**	**0**	**3**	**100**	**100**	**200**	**3 hrs**	**3**
CORE	**BEC-DS-456**	*** Artificial Intelligence Lab**	**Artificial Intelligence**	**BEC-DS-406**	**0**	**0**	**2**	**2**	**50**	**50**	**100**	**2 hrs**	**1**
Total					**12**	**0**	**7**	**19**	**650**	**550**	**1200**		**20**
Elective Courses *													
BSC	BMA-308	Mathematics-3			2	0	0	2	100	100	200	3 hrs	2
Domain Specific	BEC-DS-521	VHDL	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-522	Wireless Communication	NA		3	0	0	3	100	100	200	3hrs	3
Basic Sciences	BCS-DS-503	Artificial Intelligence	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-716	Android	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BCS-DS-404	Data Base Management Systems	NA		3	1	0	4	100	100	200	3 hrs	4
HSMC	HM-506/HM-507/ HM-508	Generic Elective I (French I/ German I/ Spanish I)			2	0	0	2	50	50	100	1.5 hrs	2
*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**													

SEMESTER-VI													
Course Type	**Course Code**	**Title of Course**	**Pre-requisite Course, if any**		**Periods/Week**				**Marks**			**Duration of Exam**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Int**	**Ext**	**Total**		
Compulsory Courses													
Core	BCS-DS-427A	Python	NA		2	0	0	2	100	100	200	3 hrs	2
Core	BCS-DS-479A	Python Lab	NA		0	0	2	2	50	50	100	3 hrs	1
Core	BEC-DS-606	Data Communication and Networking	NA		3	0	0	3	100	100	200	3 hrs	3
PROJ	PROJ-EC-600	Project Phase - I	NA		0	0	2	2	50	0	50		1
CORE	BEE-DS-502	Control Systems	Electrical Circuit & Analysis	BEE-DS-301	3	1	0	4	100	100	200	3 hrs	4
HSMC	BHM-MC-009	QAPD-III	NA		0	0	2	2	50	50	100	2 hrs	AP
Total					**9**	**0**	**6**	**16**	**450**	**400**	**850**		**11**
#NOTE: Students of B.Tech Electronics and Communication Engineering with specialization in AI and IoT in collaboration with Intel will study the following: 1) Machine Learning and Its Lab in place of Python Programming and its Lab													
B.Tech (Hons) Electronics and Communication Engineering with specialization in Artificial Intelligence and Internet of Things in collaboration with Intel Corporation (2021-2025 Batch)													
CORE	**BEC-DS-505**	*** Machine Learning**			**3**	**0**	**0**	**3**	**100**	**100**	**200**	**3 hrs**	**3**
CORE	**BEC-DS-555**	*** Machine Learning Lab**	**Machine Learning**	**BEC-DS-505**	**0**	**0**	**2**	**2**	**50**	**50**	**100**	**2 hrs**	**1**
Total					**9**	**1**	**6**	**16**	**450**	**400**	**850**		**12**
Elective Courses *													
Domain Specific	BEC-DS-601	Embedded Systems	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-602	Mobile Communication	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-651	Embedded Systems Lab	Embedded Systems	BEC-DS-601	0	0	2	2	50	50	100	2 hrs	1
Domain Specific	BEC-DS-652A	Simulation Lab	Communication Engineering Lab	BEC-DS-602	0	0	2	2	50	50	100	2 hrs	1
Domain Specific	BEC-DS-614	Fiber Optics	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-621	RTL Design Synthesis Using Verilog	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BCS-DS-403	Operating Systems	NA		3	1	0	4	100	100	200	3 hrs	4
Domain Specific	BEC-DS-611	Microwave Theory and Techniques	NA		3	0	0	3	100	100	200	3 hrs	3
HSMC	HM-606/HM-607/ HM-608	Generic Elective II (French II/ German II/ Spanish II)	Generic Elective I (French I/ German I/ Spanish I)	HM-506/HM-507/ HM-508	2	0	0	2	50	50	100	1.5 hrs	2
*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**													

SEMESTER-VII													
Course Type	**Course Code**	**Title of Course**	**Pre-requisite Course, if any**		**Periods/Week**				**Marks**			**Duration of Exam**	**Credits**
			Title	**Code**	**L**	**T**	**P**	**Total**	**Int**	**Ext**	**Total**		
Compulsory Courses													
PROJ	PROJ-EC-710*	Summer Internship-III	NA		**4 weeks**				**100**		**100**	**2 hrs**	**2**
General Proficiency	GP-EC-700	General Proficiency											**AP**
PROJ	Proj-EC-700A*	Project Phase - II/Industrial Project	NA		**0**	**0**	**8**	**8**	**200**	**100**	**300**	**2 hrs**	**5**
Total					**0**	**0**	**8**	**8**	**300**	**100**	**400**		**7**
#NOTE: Students of B.Tech Electronics and Communication Engineering with specialization in AI and IoT in collaboration with Intel will study the following: 1) Deep Learning and its Lab 2) High Performance Computing and Its Lab													
B.Tech (Hons) Electronics and Communication Engineering with specialization in Artificial Intelligence and Internet of Things in collaboration with Intel Corporation (2021-2025 Batch)													
CORE	BEC-DS-603	* Deep Learning			3	0	0	3	100	100	200	3 hrs	3
CORE	BEC-DS-653	* Deep Learning Lab	Deep Learning	BEC-DS-603	0	0	2	2	50	50	100	2 hrs	1
Domain Specific	BEC-DS-701	High Performance Computing			3	0	3	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-751	High Performance Computing Lab	High Performance Computing	BEC-DS-701	0	0	2	2	50	50	100	2 hrs	1
Total					**3**	**0**	**13**	**13**	**450**	**250**	**700**		**15**
Elective Courses *													
Domain Specific	BCS-DS-602	Machine Learning	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-715	Satellite Communication	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-718	Advanced Communication Lab	Communication Engineering	BEC-DS-502	0	0	2	2	50	50	100	2 hrs	1
Domain Specific	BEC-DS-721	Digital CMOS VLSI Design	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-713	Robotics	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-712	Radar & Navigation	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-717	Robotics Lab	Robotics	BEC-DS-713	0	0	2	2	50	50	100	2 hrs	1
Domain Specific	BEC-DS-702	AI & IoT for Practitioners Using NVIDIA Jetson Nano Board	AI and IoT		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-752	AI & IoT Lab for Practitioners Using NVIDIA Jetson Nano Board	AI and IoT		**0**	**0**	**2**	**2**	**50**	**50**	**100**	**2 hrs**	**1**
Domain Specific	BEC-DS-518	Soft Computing Techniques	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-516	IOT Analytics & Security	NA		3	0	0	3	100	100	200	3 hrs	3

*** Under Elective Courses, Inter-disciplinary, Generic, on-line Courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester. The student shall be required and allowed to opt the courses out of offered courses as per prescribed limit for maximum credits(28) in a semester and for the category of Elective Courses under University Rules.**

***Training undertaken by students during the Summer vacation after Sixth Semester(4 weeks minimum) will be evaluated as a VII Semester subject.**

SEMESTER-VIII													
Course Type	Course Code	Title of Course	Pre-requisite Course, if any		Periods/Week				Marks			Duration of Exam	Credits
			Title	Code	L	T	P	Total	Int	Ext	Total		
Compulsory Courses													
PROJ	Proj-EC-800*	Internship (24 weeks Training)			24 Weeks				200	100	300	2 hrs	10
Total									**200**	**100**	**300**		**10**
Elective Courses *													
Domain Specific	BCS-DS-727	Data Science	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEE-DS-741	PLC & Data Acquisition	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BCS-DS-823	Computational Linguistics and Natural Language Processing	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-811	Image Processing and Applications	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-812	Nanotechnology	NA		3	0	0	3	100	100	200	3 hrs	3
Domain Specific	BEC-DS-813	Verification Using UVM	NA		3	0	0	3	100	100	200	3 hrs	3

Minimum Credits required for award of B.Tech ECE with specialization in AI and IoT in collaboration with Intel	**180**	**Courses under AI and IoT Domain ***	**These Certification courses have to be cleared by the Student through appearing for exam conducted by Fice/Intel**	**Minimum Credits required for award of B.Tech ECE**	**160**
Total credits required under compulsory basket :	**145**			**Total credits required under compulsory basket :**	**126**
Minimium credits required under elective basket:	**35**			**Minimium credits required under elective basket:**	**34**

Note: Students of B.Tech Electronics and Communication Engineering with specialization in AI and IoT in collaboration with Intel will have to earn 142 credits under compulsory basket and Students of B.Tech Electronics and Communication Engineering will have to earn 124 credits.

Semester Wise Credits Distribution					
Semester	**BSC/ ESC/ HSMC Courses**	**Core Courses/ Project/ Internship**	**Program Electives**	**Interdisciplinary Electives/ Open/ Generic Elective**	**Total**
I	18				18
II	16			2	18
III	2	21			23
IV	2	19		2	23
V	2	14	6	2	24
VI		12	6	6	24
VII		7	6	5	18
VIII		10		2	12
	40	**83**	**18**	**19**	**160**

Minimum Credits to earn Degree in B.Tech ECE will be **160**
To get a Degree in B. Tech (Electronics and Communication Engineering) with Honours, a student has to earn additional **18 - 20** Credits.

VERTICALS		
AI & IoT	**Communication Systems**	**VLSI Design and Testing**
Data Base Management Systems	Wireless Communication	VHDL
Operating Systems	Mobile Communication	RTL Design Synthesis Using Verilog
Soft Computing Techniques	Simulation Lab	Digital CMOS VLSI Design
IoT Analytics and Security	Microwave Theory and Techniques	Verification Using UVM
Data Science	Satellite Communication	Nanotechnology
Computational Linguistics and Natural Language Processing	Advanced Communication Lab	Android
Image Processing and Applications	Fibre Optics	Embedded Systems
	Radar and Navigation	Robotics

SEMESTER-1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BPH-106: PHYSICS FOR ENGINEERS

Periods/week	Credits	Max. Marks	: 200
L: 3 T:0	3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Term Examination	: 100

Pre-requisite: Basic knowledge of 10+2 level Physics

Course Type: Basic Sciences

Course Outcomes: The students will be able to:

BPH-106.1 Discuss and explain the key concepts and principles of quantum physics, lasers and opticalfibres

BPH-106.2 Apply the basic concepts of semiconductors and devices based on them

BPH-106.3 Analyze the structure, characterization techniques and applications of advanced material.

BPH-106.4 Recall the basic concept of electromagnetism and understand their applications to the theory ofelectromagnetic waves.

Unit-1 Semiconductors (8 Lectures)

Physical properties of semiconductors, direct and indirect band gap semiconductors, compound semiconductors, organic and inorganic semiconductors, Fermi level and Fermi energy, occupation probability, concentration of charge carriers, generation and recombination, carrier transport: drift and diffusion, energy band diagram of unbiased and biased P N Junction, Light Emitting Diode, Photodetectors - p-n photodiode, PIN, Photoconductivity, Effect of impurity & Traps, Photovoltaic effect and Solar cell.

Unit-2 Quantum Physics (8 Lectures)

Limitations of classical physics, Black-body radiations, Planck's hypothesis, Photo-electric effect, Compton effect, Uncertainty principle, Matter waves, Phase and group velocity, Schrodinger's equations (time dependent and independent), Particle in a box (motion in one dimension), Basics of quantum statistics.

Unit-3Lasers and Optical Fibres (8 Lectures)

Introduction to laser, Spontaneous and stimulated emissions of radiations, Einstein's coefficients and relation among them, Population inversion and laser pumping, Characteristics of lasers, Components of laser, He-Ne laser, Semiconductor laser, Applications of laser.

Introduction to optical fibres, Acceptance angle and acceptance cone, Numerical aperture, Classification of fibres, Attenuation, Losses associated with optical fibres, Merits and applications of optical fibres.

UNIT 4: Advance Material and Synthesis (6 Lectures)

Introduction to nanomaterials, Nano-science and nano-technology, Two main approaches in nanotechnology, Bottom up technique, Top down technique, Quantum dot and graphene, Methods to produce Nanomaterials, Chemical vapour deposition, Sol-gel process, Molecular beam epitaxy, Physical and chemical properties of nanomaterials, Carbon nanotubes: single and multi-walled nanotubes, Synthesis of Nanotubes: carbon arc method, Laser evaporation method, Sputtering, applications of advanced materials.

UNIT 5: Investigating Techniques (6 Lectures)

Properties of X-Ray,Braggs' Law, Bragg's Spectrometer, Rutherford Back Scattering, Raman effect and Raman spectroscopy, Hall effect, Vander Pauw measurements for carrier density, resistivity, Hot-point probe measurement, AFM, SEM, photoluminescence spectroscopy, band gap by UV-Vis spectroscopy.

Unit-6 Electrodynamics (8 Lectures)

Divergence and curl of electrostatic field, Laplace's and Poisson's equations for electrostatic potential. Solutions of Laplace equation in one dimension, Dielectric Polarization and Dielectric constant, Piezoelectricity, Bio-Savart law and Ampere's circuital theorem, Continuity equation for current densities, Displacement current, Maxwell's equations, Electromagnetic energy – Flow of energy and Poynting vector, The wave equation; Plane electromagnetic waves in vacuum, their transverse nature, Energy carried by electromagnetic waves.

Text Books/ Reference Books:

1. P. Bhattacharya,2017, Semiconductor Optoelectronic Devices, Pearson education.
2. D.J Griffiths, 2015, Introduction to Electrodynamics, Pearson education.
3. Avadhanulu and Kshirsagar,2014, A textbook of Engineering Physics S. Chand.
4. S.P. Taneja,2018, Modern Physics for Engineers, R. Chand & Co.
5. Mark Ratner and Daniel Ratner, 2003,Nanotechnology, Pearson.
6. M.N.O. Sadiku, 2015, Elements of Electromagnetics, Asian Edition, Oxford Higher Education.

Distribution of Continuous Evaluation:

Sessional-I	30%
Sessional-II	30%
Assignment/Tutorial	20%
Class Work/ Quiz	20%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Assignments, Sessional and End Semester Examination paper will consist of various difficulty levels to accommodate the different capabilities of students. Assessment should cover all course outcomes and upper limit for lower order skills will be 40% (for knowledge-oriented questions). However, weightage for different cognitive levels in the question papers can vary.

Instructions for paper setting: The paper setter must ensure the coverage of entire syllabus while setting the question papers and mention the learning outcomes across each section to be measured by the examination. Weightage of the sections may vary as per the number of respective lecture hours mentioned in the syllabus.Action verbs should be used from Bloom's Taxonomy while designing question papers.

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BPH-106.1	2	2	1	2	3	-	-	-	-	-	2	3
BPH-106.2	3	1	3	-	2	1	1	-	-	-	-	3
BPH-106.3	3	2	2	-	2	2	1	-	-	-	-	2
BPH-106.4	3	3	3	1	1	3	1	-	-	-	-	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BMA-102: MATHEMATICS-1

(Calculus and Linear Algebra)

Periods/week	Credits	Max. Marks	:200
L: 3 T: 1	4	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Pre-requisites: The students must have the knowledge of mathematical concepts of Intermediate level.

Course Type: Basic Sciences

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the outcomes are:

BMA-102.1. Students will be able to understand the role of mathematics in engineering.
BMA-102.2. Students will be able to define the terminology of Integration, Differentiation, Matrices and Infinite Series.
BMA-102.3. Students will be able to explain improper integrals, power series, and linear system of equations, convergence of series and physical interpretation of vector function.
BMA-102.4. Students will be able to demonstrate the knowledge of evolutes and involutes, rank of matrices, expansion of functions and diagonalization.
BMA-102.5. Students will be able to interpret the concepts of integration, differentiation, matrices and series to solve real life problems.
BMA-102.6. Students will be able to correlate the surface area, maxima and minima, eigen vectors.

PART-A

Unit 1: Integral Calculus

Evolutes and involutes, Evaluation of definite and improper integrals, Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit 2: Differential Calculus

Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule, Maxima and minima.

Unit 3: Sequences and Series

Convergence of sequence and series, tests for convergence, Power series, Taylor's series, series for exponential, trigonometric and logarithm functions, Fourier series: Half range sine and cosine series, Parseval's theorem.

PART-B

Unit 4: Multivariable Calculus (Differentiation)

Limit, continuity and partial derivatives, directional derivatives, total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers, gradient, curl and divergence.

Unit 5: Matrices

Inverse and rank of a matrix, rank-nullity theorem, System of linear equations, Symmetric, skew-symmetric and orthogonal matrices, Determinants, Eigenvalues and Eigenvectors, Diagonalization of matrices, Cayley-Hamilton theorem and Orthogonal transformation.

Suggested Text/Reference Books

1. G.B. Thomas and R.L. Finney, 2002, Calculus and Analytic geometry, 9thEdition, Pearson.
2. Erwin kreyszig, 2006, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons.
3. Veerarajan T., 2008, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
4. Ramana B.V., 2010, Higher Engineering Mathematics, Tata McGraw Hill New Delhi.
5. D. Poole, 2005, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole.
6. N.P. Bali and Manish Goyal,2008, A text book of Engineering Mathematics, Laxmi Publications.
7. B.S. Grewal, 2010, Higher Engineering Mathematics, Khanna Publishers, 36th Edition.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials.

Sessional tests.

Surprise questions during lectures/Class Performance.

End Term Examination.

Course Articulation Matrix

CO Statement (BMA-102)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BMA-102.1	3	3	1	2	2	--	--	--	--	--	--	2	--	--	--	--
BMA-102.2	3	3	1	2	2	--	--	--	--	--	--	1	--	--	--	--
BMA-102.3	3	3	2	2	3	--	--	--	--	--	--	2	--	--	--	--
BMA-102.4	3	3	1	1	2	--	--	--	--	--	--	1	--	--	--	--
BMA-102.5	3	3	2	2	3	--	--	--	--	--	--	2	--	--	--	--
BMA-102.6	3	3	1	2	2	--	--	--	--	--	--	2	--	--	--	--

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEE-101A: BASIC ELECTRICAL ENGINEERING

Periods/week	Credits	Max. Marks	: 200
L: 3 T:	3	Continuous Evaluation	: 100
Duration of Examination: 3 Hours		End Semester Examination	: 100

Pre-requisites

Course Type: Engineering Science

Course Outcomes: After completion of this course the students will be able to

BEE-101A.1 understand the components of electrical network, low voltage electrical installation, earthing and working of batteries.

BEE-101A.2 apply the basic theorems and laws for solving both dc and ac networks.

BEE-101A.3 differentiatebetween single phase series and parallel circuits and three phase system.

BEE-101A.4 explain the construction and working of transformers, electrical machines and power converters

Unit 1: DC CIRCUITS (8 hours)

1.1 Electrical circuit elements (R, L and C), voltage and current sources,

1,2Kirchoff Voltage and Current Laws,

1.3 Analysis of simple circuits (two loops) with dc excitation ,

1.4 Superposition Theorem,

1.5 Thevenin's Theorem,

1.6 Norton's Theorem,

1.7 Time domain analysis of first order system- RL circuit,

1.8 Time domain analysis of first order system- RC circuit.

Unit 2: AC CIRCUITS (8 hours)

2.1 Single Phase-AC Generation,

2.2 Sinusoidal Waveform- peak value average and rms values

2.3 Phasor representation, L, C, RL, RC circuit

2.4 RLC Series Circuits

2.5 Power factor, Real power, Reactive power and Apparent power

2.6 RLC parallel circuits

2.7 Resonance

2.8 Three Phase Emf Generation, Delta and Star Connections

2.9 Voltage and current relation in star and delta connections

Unit 3: TRANSFORMERS (6 hours)

3.1Magnetic materials

3.2 BH characteristics,

3.3 Working Principle and Emf Equation of transformer,

3.4 Ideal and Practical transformer,

3.5 Equivalent circuit Losses in transformer,

3.6 Efficiency and regulation of transformer

3.7 Auto transformer

3.8 Three phase transformer connections.

Unit 4: DC MACHINES (5 hours)

4.1 Construction and working of DC motor,

4.2 Torque-speed characteristic and speed control of separately excited dc motor,

4.3 Construction and working of DC generator,

4.4 EMF equation of DC generator,

4.5 Introduction to power converters/power switching devices.

Unit 5: AC MACHINES (6 hours)

5.1 Generation of rotating magnetic fields,

5.2 Construction and working of a three-phase induction motor

5.3 Significance of torque-slip characteristic,

5.4 Loss components and efficiency of three phase induction motor

5.5 Starting and speed control of induction motor, 5.6 Single-phase induction motor working and types

5.7 Construction and working of synchronous generators.

Unit 6: ELECTRICAL INSTALLATIONS (6hours)

6.1Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB,

6.2 Types of Wires and Cables,

6.3 Earthing,

6.4 Types of Batteries, Important Characteristics for Batteries,

6.5 Elementary calculations for energy consumption,

6.6 Power factor improvement and battery backup.

Text Books/ Reference Books:

1. I. J. Nagrath, D. P. Kothari ,2007, Basic Electrical Engineering, TMH.
2. S. NathChakrabarti, C. K. Chanda , 2009, Basic Electrical Engineering, TMH,2009.
3. B. L. Thereja , 2005, Electrical Technology Vol.1, S Chand.
4. V. N. Mittal, Aravind Mittal, 2007, Basic Electrical Engineering,TMH 2007.
5. S N Singh , 2011, Basic Electrical Engineering, PHI.
6. D. C. Kulshreshtha , 2009, Basic Electrical Engineering, McGrawHill.
7. Leonard S Bobrow,2011,Fundamentals of Electrical Engineering, 2nd edition, Oxford University Press.
8. E. Hughes ,2010, Basic Electrical Engineering, Pearson.
9. S K Sahadev ,2015, Basic Electrical Engineering, Pearson India.

Software required/Weblinks

http://nptel.ac.in/courses/108105053/

https://nptel.ac.in/courses/108108076/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment	20%
Class Performance	10%
Attendance	10%

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BEE-101A.1	3	3	2	1	1	-	-	-	-	-	-	2	3	1	1	1
BEE-101A.2	3	3	3	1	1	-	-	-	-	-	-	2	3	1	1	1
BEE-101A.3	3	3	3	1	1	-	-	-	-	-	-	2	3	3	1	1
BEE-101A.4	3	3	3	1	1	-	-	-	-	-	-	2	3	1	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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BME-101A: ENGINEERING GRAPHICS & DESIGN

Periods/week Credits	Max. Marks: 200
L: 0 T: 0 P: 4 2	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Prerequisites:

Course Type: Engineering Science Course

Course Coordinator / Co-Coordinator:

Course Outcomes:

After completion of this course the students will be able to

BME-101A.1	Understand the role and importance of Engineering Graphics, design/drafting in cognitive development.
BME-101A.2	Conceptualize engineering drawing and descriptive geometry to understand different components and machineries.
BME-101A.3	Visualize objects with the help of engineering principles, projectiontheories including their applications to solve problems related to engineering and production.
BME-101A.4	Develop capability of understanding engineering drawing problems and implementation of respective solution.
BME-101A.5	Develop capability of selection of solutions for a given designproblem.
BME-101A.6	Develop of capability of designing a product or assembly with its various components with a systematic design approach

Theory (Detailed Content)

Traditional Engineering Graphics:

Principles o f Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles;Isometric Projection;Surface Development;Perspective;Reading a Drawing; SectionalViews;Dimensioning&Tolerances; TrueLength,Angle;intersection, Shortest Distance.

(**Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory**)

Part-A

Unit 1: Introduction to Engineering Drawing, Orthographic Projections

Principles of Engineering Graphics and their significance, usage of drawing instruments,lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Unit 2: Projections of Regular Solids & Sections and Sectional Views of Right Angular Solids

Inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only).

Unit 3: Isometric Projections

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric

Views to Orthographic Views and Vice-versa, Conventions;

Theory (Detailed Content)

Computer Graphics

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; ModelViewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing;Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(**Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory**)

Part-B

Unit 4: Overview of Computer Graphics, Customization & CAD Drawing

Listing the computer technologies that impact on graphical communication, Demonstratingknowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids;consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning andtolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines,Applying various ways of drawing circles;

Unit 5: Annotations, layering, other functions

Applying dimensions to objects, applying annotations to drawings; Setting up and use ofLayers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Unit 6: Demonstration of a simple team design project

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

1. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
2. Narayana, K.L.&P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

Weblinks:

https://nptel.ac.in/courses/112103019/

https://nptel.ac.in/courses/112104172/

Evaluation Tools:

Surprise questions during lab/Class Performance

Term end examination/viva

Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 11	PSO 12	PSO 13
BME-101A.1	2	1	1	1	1	2	1	2	1	1	2	3	3	3	2
BME-101A.2	2	2	3	1	1	2	2	2	2	2	3	2	3	3	1
BME-101A.3	2	2	2	2	2	1	2	1	3	2	2	2	3	3	2
BME-101A.4	3	3	2	3	2	1	2	2	1	1	2	1	3	3	1
BME-101A.5	3	3	2	3	2	1	2	1	1	1	2	1	3	-	-
BME-101A.6	2	1	3	2	3	2	2	2	3	2	2	1	-	-	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BPH-151A: PHYSICS LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Pre-requisite: Basic knowledge of 10+2 level Physics

Course Type: Basic Sciences Courses

Course Outcomes: The students will be able to:

BPH-151A.1 calculate zero error, least count, maximum percentage error, percentage error and understand their importance

BPH-151A.2 understand the principle, concept and working of the experiments

BPH-151A.3 rearrange/assemble the different components of a device or a circuit

BPH-151A.4 describe the methodology of science and the relationship between observation and theory

List of Experiments:

1. To calculate the hysteresis loss and magnetic susceptibility by tracingB- H curve.
2. To determine the value of Planck's constant h by a photo cell.
3. To determine the grating element of a given grating by using LASER.
4. To study Hall Effect in a semiconductor and to find (i) Hall voltage and Hall coefficient (ii) number of charge carriers per unit volume (iii) mobility.
5. To draw the characteristics of a solar cell and to find the fill factor.
6. To find the band gap of an intrinsic semiconductor using four probe method.
7. To draw the V-I characteristics of a PIN diode.
8. To determine numerical aperture of an optical fibre.
9. Todetermine the volume magnetic susceptibility of manganese sulphatesolution at different concentrations.
10. To find the charge to mass (e/m) ratio of an electron.
11. To study the resonance phenomena in LCR circuits.
12. To study the variation of magnetic field from Helmholtz coil.
13. To determine the moment of inertia of a flywheel.
14. To determine the Young's modulus of the material of a given beamsupported on two knife-edges and loaded at the middle point.
15. To determine the Modulus of Rigidity of a wire by Maxwell's Needle.

Text Books/References:

1. S. L. Gupta & V. Kumar, Practical Physics, 2018, Pragati Prakashan.

2. S.L. Arora, B.SC, Practical Physics, 2010, S. Chand.

3. NPTEL video lectures for Experimental Physics.

Instructions for Exam: One experiment out of 10 given randomly needs to be performed in exams.

Distribution of Continuous Evaluation:

Viva-I	30%
Viva-II	30%
File/Records	20%
Class Work/ Performance	20%

Evaluation Tools:

Experiments in lab

File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BPH-151A.1	3	1		1				1	1	1		3
BPH-151A.2	2		2		2				1	1		2
BPH-151A.3	2	3	2	3	3				3		1	3
BPH-151A.4	3	1	2		1		1	1	1	1		3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEE-151A: BASIC ELECTRICAL ENGINEERING LAB

Periods/week	Credits	Max. Marks	: 100
P: 2	1	Continuous Evaluation	: 50
Duration of Examination: 2 Hours		End Semester Examination	: 50

Course Outcomes

After completion of this course the students will be able to

BEE-151A.1 familiarize with the measuring instruments, breadboard, CRO, components of LT installation

BEE-151A.2 understand the transformers connection both single and three phase.

BEE-151A.3 study the working principles of electric machines and power converters

BEE-151A.4design a simple PCB with software.

LIST OF EXPERIMENTS:

1. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors and verification of basic laws.
2. To measure the steady-state and transient time-response of R-L/R-L circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. To examine sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage.
4. To find the resonance frequency inR-L-C circuits..
5. To observe the no-load current waveform of transformer on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
6. To perform Load test on a transformer: measurement of primary and secondary voltages and currents, and power.
7. To connect Three-phase transformers in Star and Delta and verify voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side and to measure three-phase power in balanced three-phase circuits.
8. Identification of various types of Printed Circuit Boards (PCB) and soldering techniques.
9. Introduction to PCB design software.
10. PCB Lab a) Artwork & printing of simple PCB b) Etching & drilling of PCB.
11. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
12. To draw Torque -Speed Characteristic of dc motor.

13. To find Synchronous speed of two and four-pole three-phase induction motors, check Direction reversal by change of phase-sequence of connections and to draw Torque-Slip Characteristic of an induction motor.
14. To Study components of LT, switchgear- MCB, ELCB, MCCB.
15. To Study DC-DC Converter.

Text Books:

Dr. N K Jain ,2010, A text book of Practicals in Electrical Engineering, Dhanpatrai Publishing Co.

Instructions for Exam: Every student needs to complete 10 experiments in a semester. One experiment out of 10 given randomly needs to be performed in exams.

Parameter	Weightage
Two Mid-Term Viva	60%
File/Record Keeping	20%
Class Performance	10%
Class Attendance	10%

Evaluation Tools:

Experiments in lab

File work/Class Performance

Viva (Question and answers in lab)
End Term Practical Examination

COURSE ARTICULATION MATRIX

CO Statement (BEE-151A)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEE-151A.1	3	3	2	1	1	-	-	-	-	-	-	2	3	1	1	1
BEE-151A.2	3	3	3	1	1	-	-	-	-	-	-	2	3	1	1	1
BEE-151A.3	3	3	3	1	1	-	-	-	-	-	-	2	3	3	1	1
BEE-151A.4	3	3	3	1	1	-	-	-	-	-	-	2	3	1	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-100A: Artificial Intelligence for Engineers

Periods/week	Credits	Max. Marks : 200
L :2 T: 0	2.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Pre-Requisite: Nil

Course Type: Engineering Science Course

Course Outcomes: The Students will be able-

BCS-100A.1 To understand evolution of Artificial Intelligence.

BCS-100A.2 To familiarize with artificial intelligence problems and their formulations.

BCS-100A.3 To Understand Intelligent system, Agents & its environment.

BCS-100A.4 To understand applications of artificial intelligence.

Unit-1: AI Introduction, Background and History

1.1 Introduction to AI
1.2 Foundations of AI
1.3 AI Evolution
1.4 Introduction to AI programming languages

Unit-2: AI Problem Formulation

2.1 AI problem formulation
2.2 Problem characteristics
2.3 Production System
2.4 Production System characteristics

Unit 3: Intelligent System & Agents

3.1 Introduction to intelligence system

3.2 Types of Intelligence

3.3 Difference between Human and Machine learning

3.4 Introduction to Agent & environment

3.5 Structure of Intelligent Agent

3.6 Nature and Properties of Environment.

Unit-4: AI Applications

4.1 Robotics

4.2 Natural Language Processing

4.3Computer Vision

4.4 Health Care

4.5 Education

4.6 Expert System

Text Books / Reference Books:

1. Elain Rich and Kevin Knight (2009), Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2. Stuart J.Russel and Peter Norvig (2009), Artificial Intelligence-A modern approach: 3rd edition, Pearson.
3. Patrick Henry Winston (1992), Artificial Intelligence , 3rd edition, , Pearson.
4. George F Luger, (2009), Artificial Intelligence :Structures and Strategies for Complex Problem Solving , University of New Mexico,6th edition, Pearson.
5. V S Janakiraman, Parerback (2005), Foundations of Artificial Intelligence And Expert Systems : 3rd edition, Macmillan India Limited

Software required/Weblinks:

http://artint.info/html/ArtInt_351.html

http://www.tutorialspoint.com/artificial_intelligence/

http://www.compinfo-center.com/tpai-t.htm

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Assessment Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX:

CO Statement (BCS-100A)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-100A.1	2	2	1	2									2	2	3
BCS-100A.2	2	3	2	3									2	2	3
BCS-100A.3	3	2	2	2									3	3	3
BCS-100A.4	3	3	2	3									2	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-121: ENGLISH

Periods/week Credits	Max. Marks : 100
L: 2 T:0 0	Continuous Evaluation : 50
Duration of Examination: 1.5 Hrs	End Semester Examination: 50

Course Outcome:

BHM- 121.1 The employability of students will improve as they will be able to communicate effectively and become aware about the importance of the four pillars of Communication – listening, speaking, reading and writing.
BHM- 121.2 The verbal and non- verbal communication skills of the students will improve.
BHM- 121.3 They will be able to give presentations confidently and also speak fluently in various public speaking platforms like debate, declamation, and extempore. They will learn the effective use of body language.
BHM- 121.4 They will be skilled in fluent reading
BHM- 121.5 Students would be able to understand how they have to be professional in their grooming and attitude
BHM- 121.6 They will be able to write effective letters/ application for professional purposes.

Unit 1: Listening Skills

1.1 The art of listening
1.2 Practicing listening skills
1.3 Intensive listening Vs extensive listening
1.4 Listening and note taking
1.5 Exercises of active listening.

Unit 2: Speaking Skills

2.1 Speaking practice in various social situations
2.2 Constructing small talks
2.3 Delivering Presentations
2.4 Body Language

Unit 3: Reading Skills

3.1 The art of effective reading
3.2 Overcoming common obstacles
3.3 Types of reading – skimming, scanning, extensive reading, intensive reading
3.4 Tips for effective reading.

Unit 4: Writing Skills

4.1 Avoiding common errors in construction of sentences and language

4.2 Practicing letter writing
4.3 Email Etiquette

Unit 5: Professional Grooming and Etiquette

5.1 Professional grooming
5.2 Personal Grooming
5.3 Professional Etiquette
5.4 Courtesy and communication discipline

Unit 6: Intercultural Communication

6.1 Cultural Sensivity
6.2 Diversity in Inclusion
6.3 Avoiding Stereotype
6.4 Cross Cultural Communication
6.5 Racial Discrimination and factors constituting racial harassment

Text Books/Reference Books:

1. Dale Carnegie, 2018, How to develop self- confidence and Influence people.
2. J.K Gangal,Developing Writing Skills in English ; Edition 2018
3. Vivek Bindra, Everything about Corporate Etiquette.

Instructions for paper setting: Seven Questions would be set in total. Part A would be compulsory and students would have to attempt two questions each from Part B and Part C.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement BHM- 121	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BHM- 121.1	-	-	-	-	-	-	-	1	1	3	-	1	-	-	-	1
BHM- 121.2	-	-	-	-	-	-	-	1	1	3	-	1	-	-	-	1
BHM- 121.3	-	-	-	-	-	-	-	-	-	3	-	1	-	-	-	-
BHM- 121.4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
BHM- 121.5	-	-	-	-	-	-	-	-	2	2	-	1	-	-	-	3
BHM- 121.6	-	-	-	-	-	-	-	1	-	3	-	1	-	-	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-MC-001: CONSTITUTION OF INDIA

Periods/week Credits	Max. Marks : 100
L:0 T:1 P: 0 AP	Continuous Evaluation : 50
Duration of Examination: 2 Hrs	End Semester Examination: 50

Course Type: HSMC

1. Background: India's struggle for independence, Formation of the Constituent Assembly, The Union and its Territory : Nomenclature, Formation of New States and Alteration of Areas, Citizenship : Citizenship at the Commencement of the Constitution, Rights of Citizenship of certain persons, Rights of Citizenship of certain persons of Indian origin residing outside India, Continuance of the rights of Citizenship, Parliament to regulate the right of the Citizenship by law.

2. Fundamental Rights and Directive Principles : Definition, Laws inconsistent with or in derogation of the Fundamental Rights, Equality before law, Prohibition of discrimination on grounds of religion, race, caste, sex or place of birth, Equality of opportunity in matters of public employment, Abolition of untouchability, Abolition of Titles- Right to Freedom, Right against Exploitation, Right to freedom of religion, Cultural and Educational rights, Right to constitutional remedies, Directive principles of State Policy : Definition, Right to work, Right to education and to public assistance in certain cases, provisions for just and humane condition of work and maternity relief, uniform civil code for the citizens, protection and improvement of environment and safeguarding of forests and wildlife, protection of monuments and places and objects of national importance, separation of judiciary from executive, promotion of international peace and security and Fundamental Duties.

3. The Union: The executive, The President and Vice President of India, Council of Ministers, Attorney General for India, Parliament, Legislative procedure, The Union Judiciary: Establishment and constitution of Supreme Court, Powers and Functions of Supreme Court, Original Jurisdiction of the Supreme Court, The States : Definition, The Governor, Council of Ministers, The Advocate General for the State, The State Legislature, Legislative Procedure, High Courts in the State, The Union Territories, The Panchayats, Municipalities, Relations between the Union and the States.

4. Services under the Union and the States: Services, Public Service Commissions, Elections: Election Commission of India, Emergency Provisions : Proclamation of Emergency, Amendment of the Constitution, Temporary, Transitional and Special Provisions, Schedules : First to Tenth Schedule and Miscellaneous.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Class Work/ Performance	20%
Attendance	20%

SEMESTER-2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCH-106: CHEMISTRY FOR ENGINEERS

Periods/week		Credits	Max. Marks	: 200
L: 2	T: 0	2	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs			End Term Examination	: 100

Pre-requisite: Basic knowledge of 10+2 level Chemistry

Course Type: Basic Sciences

Course Outcomes: The course will enable the student to-

BCH-106.1. Apply fundamental principles to predict the structure, stereochemistry, bonding and general properties of materials.

BCH-106.2.Predict potential applications and practical utility of chemistry in different areas and propose suitable analytical techniques for practical applications.

BCH-106.3. Develop the understanding of water treatment techniques, electrochemical cells and combustion technology.

Unit 1: Water Treatment Chemistry (5 Lectures)

Impurities in water, Drinking Water quality standards, Hardness, types and its determination by EDTA method, Alkalinity and its determination, numerical problems based on hardness & alkalinity, Water softening methods: zeolite, ion-exchange process, Desalination of water: Reverse osmosis (RO) & Electro-dialysis process

Unit 2: Electrochemical cells and Fuels (5 Lectures)

Basic concepts of cells, Primary cells, Secondary cells and batteries, Fuel cells, Fuels and their types, Combustion technology

Unit 3: Phase Rule and its applications (4 Lectures)

3.1 Terminology of Gibb's phase rule and problems based on phase rule equation, One component system (water), Two component Eutectic system (Pb-Ag), Industrial applications of phase diagrams

Unit 4: Atomic and molecular structure (5 Lectures)

Limitations of classical mechanics in treating atomic and molecular phenomena, Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and nanoparticles, Molecular orbital treatment for homo-nuclear diatomic molecules, Bonding in Coordination Compounds: Crystal field theory

Unit-5: Stereochemistry (4 Lectures)

Structural isomers and stereoisomers, Representations of 3 dimensional structures, Enantiomers, diastereomers, Absolute configurations and conformational analysis

Unit6: Analytical Techniques(5 Lectures)

Basic Principles of spectroscopy, UV- VIS spectroscopy and its applications, IR spectroscopy and its applications, Principle and analytical applications of Atomic Absorption spectroscopy, brief overview of Inductively coupled plasma mass spectrometry

Text Books/ Reference books/Web references:

1. P. C. Jain and Monica Jain, Engineering Chemistry, 2017, Dhanpat Rai Publishing Company.
2. Prasanta Rath, SubhenduChakroborty, Chemistry, 2018, Cengage Learning Publishers.
3. B. H. Mahan,2010, University Chemistry, Pearson Education.
4. C. N. Banwell, 2008, Fundamentals of Molecular Spectroscopy, McGraw Hill Education India.
5. GourkrishnaDasmohapatra, 2019, Chemistry-I, Vikas Publishing.
6. https://nptel.ac.in/courses/103/108/103108138/
7. https://nptel.ac.in/courses/122/101/122101001/

Distribution of Continuous Evaluation:

Sessional-I	30%
Sessional-II	30%
Assignment/Tutorial	20%
Class Work/ Quiz	20%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Assignments, Sessional and End Semester Examination paper will consist of various difficulty levels to accommodate the different capabilities of students. Assessment should cover all course outcomes and upper limit for lower order skills will be 40% (for knowledge-oriented questions). However, weightage for different cognitive levels in the question papers can vary.

Instructions for paper setting: The paper setter must ensure the coverage of entire syllabus while setting the question papers and mention the learning outcomes across each section to be measured by the examination. Weightage of the sections may vary as per the number of respective lecture hours mentioned in the syllabus.Action verbs should be used from Bloom's Taxonomy while designing question papers.

Course articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BCH-106.1	3	3	1	-	1	-	-	-	-	-	-	2
BCH-106.2	3	3	2	-	2	2	2	-	-	-	-	2
BCH-106.3	3	3	2	-	2	2	2	-	-	-	-	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BMA-202: MATHEMATICS-2

(Calculus, ordinary Differential Equations and Complex variables)

Periods/week Credits Max. Marks : 200

L: 3 T: 1 4 Continuous Evaluation : 100

Duration of Examination: 3 Hrs End Semester Examination: 100

Pre-requisites: The students must have the knowledge of mathematical concepts of Intermediate level and Mathematics-1.

Course Type: Basic Sciences

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the outcomes are:

BMA-202.1 Students will be able to recognize the application of mathematics in engineering.
BMA-202.2 Students will be able to describe the knowledge of multiple Integration and Differentiation in the field of complex functions.
BMA-202.3 Students will be able to demonstrate the concepts of differential equations of higher order.
BMA-202.4 Students will be able to distinguish between real and complex functions.
BMA-202.5 Students will be able to interpret the concept of complex integration for those functions which are not defined on real line.
BMA-202.6 Students will be able to evaluate improper integrals using complex integration.

PART-A

Unit 1: Multivariable Calculus (Integration)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities), Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds, Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, theorems of Green, Gauss and Stokes.

Unit 2: First Order Ordinary Differential Equations

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Unit 3: Ordinary Differential Equations of Higher Orders

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

PART-B

Unit 4: Complex Variable – Differentiation

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties, Conformal mappings, Mobius transformations and their properties.

Unit 5: Complex Variable – Integration

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text/Reference Books

1. G.B. Thomas and R.L. Finney, 2002, Calculus and Analytic geometry, 9th Edition, Pearson.
2. Erwin kreyszig, 2006, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons.
3. W. E. Boyce and R. C. DiPrima, 2009, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India.
4. S. L. Ross, 1984, Differential Equations, 3rd Ed., Wiley India.
5. E. A. Coddington, 1995, An Introduction to Ordinary Differential Equations, Prentice Hall India.
6. E. L. Ince, 1958, Ordinary Differential Equations, Dover Publications.
7. J. W. Brown and R. V. Churchill, 2004, Complex Variables and Applications, 7th Ed., Mc-Graw Hill.
8. N.P. Bali and Manish Goyal, 2008, A text book of Engineering Mathematics, Laxmi Publications.
9. B.S. Grewal, 2010, Higher Engineering Mathematics, 36th Edition, Khanna Publishers.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials.

Sessional tests.

Surprise questions during lectures/Class Performance.

End Term Examination.

Course Articulation Matrix

CO Statement (BMA-202)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BMA-202.1	3	3	2	2	2	--	--	--	--	--	--	2	--	--	--	--
BMA-202.2	3	3	2	2	2	--	--	--	--	--	--	1	--	--	--	--
BMA-202.3	3	3	2	2	3	--	--	--	--	--	--	2	--	--	--	--
BMA-202.4	2	2	3	1	2	--	--	--	--	--	--	1	--	--	--	--
BMA-202.5	3	3	2	2	3	--	--	--	--	--	--	2	--	--	--	--
BMA-202.6	3	3	1	2	2	--	--	--	--	--	--	2	--	--	--	--

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BME-102: WORKSHOP/MANUFACTURING PRACTICES

Periods/weekCredits	Max. Marks :200
L: 0 T: 0P:4 2	Continuous Assessment :100
Duration of Examination:3Hrs	End Semester Examination :100

Prerequisites: basic knowledge of Science and Mathematics Course

Type: Engineering Science Course

Course Outcomes:

After completion of this course the students will be able to

BME-102.1 Learn the basic manufacturing/fabrication processes and develop skills to fabricate with their own hand.

BME-102.2 Understand how to operate various traditional and modern machine tools used inindustries.

BME-102.3 Apply knowledge of the dimensional accuracies and dimensional tolerances, basics of various measuring instruments, hand tools and cuttingtools.

BME-102.4 Acquire knowledge of safetymeasurements

BME-102.5 Understand the impact of manufacturing engineering solution. BME-102.6 Assemble different mechanicalcomponent/parts

Lectures & Videos (10 Hrs)

(i) Detailed Content

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3lectures).
2. CNC machining, Additive manufacturing (1lecture)

3. Fitting operations & power tools (1lecture)
4. Electrical &Electronics (1lecture)
5. Carpentry (1lecture)
6. Plastic moulding, glass cutting (1lecture)
7. Metal casting (1lecture)
8. Welding (arc welding & gas welding), brazing (1lecture)

(ii) Workshop Practice: (60hours)

1. Machine shop (10hours)
2. Fitting shop (8hours)
3. Carpentry (6 hours)
4. Electrical & Electronics (8 hours)
5. Welding shop (8 hours) (Arc welding 4 hrs + gas welding 4hrs)
6. Casting (8hours)
7. Smithy (6hours)
8. Plastic moulding & Glass Cutting (6hours)

Students Project Fabrication

Students have to fabricate product from the assigned list with their own hands. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different workshop processes. The final product should be assembly of different components fabricated by different workshop practices.

For e.g. Tack-hammer; Project Display Stand; Pen stand, Screw Driver, Variable size Spanner, Electrical Extension Board with electronic circuits or any other product which should involve multiple workshop practices to fabricate a single product.

Each student will be issued the drawings of the product assembly along with the drawing of the sub-part assembly, mentioning the dimensions, tolerance, sub-products used.

Students should follow the process planning sheet of the product and get involved in different workshop practices to complete the jobs for final submission.

Note: Each student should do more than one product to get hands on experience of all the workshop practices.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.

Reference Books:

1. Roy A. Lindberg, " Processes and Materials of Manufacture" , 4th edition, Prentice Hall India, 1998.
2. Rao P.N., " Manufacturing Technology" , Vol. I and Vol. II, Tata McGrawHill House, 2017.

Weblinks:

https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-me21/

Instructions for setting of Paper Seven questions are to set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each part A and part B (one from each unit). Student needs to attempt two questions out of three questions from each part. Each question will be of 20 marks.

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BME-102.1	3	3	3	3	2	1	1	2	2	2	2	3	3	3	3	3
BME-102.2	3	3	3	3	3	2	1	2	2	2	2	2	2	2	2	2
BME-102.3	3	3	3	3	3	2	2	1	2	2	1	2	2	2	2	2
BME-102.4	2	2	2	2	3	2	1	1	2	1	2	2	3	2	2	2
BME-102.5	3	2	2	2	2	3	3	2	2	2	2	2	3	2	2	2
BME-102.6	3	3	3	2	2	1	2	2	2	3	2	2	2	2	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BBT-100: BIOLOGY FOR ENGINEERS

Periods/week Credits	Max. Marks : 200
L: 2 T: 0 P:0 02	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination:100

Pre-requisites: Knowledge of 10+2 Science

Course Type: Basic Sciences

Course Outcomes:

The students will be able to-

BBT-100.1 describe the taxonomic diversity of life forms and their functions.

BBT-100.2 assess the role of biomolecules in physiology and genetics.

BBT-100.3 illustrate the structural and functional organization of the human body.

BBT-100. 4 apply the principles of biology for sustenance.

PART-A

Unit 1: The Living World

1.1 What is living World?

1.2 Diversity in the living world

1.3 Taxonomy and Biological Classification

1.4 Structural organization in plants and animals

1.5 Cell- The unit of Life

Unit 2: Microbiology

2.1 Microbial diversity, Ecology and Population dynamics, Microbial growth on surfaces Environmental effect on microbial growth.

2.2 Bioremediation, examples of bioremediation, Acid mine drainage, Enhanced metal recovery, Wastewater microbiology

2.3 Solid waste microbiology, Landfills, Leachate, Anaerobic degradation phases.

2.4 Antimicrobial resistance

PART-B

Unit 3: Biochemistry

3.1 Carbohydrates- monosaccharides, disaccharides and Polysaccharides,

3.2 Lipids- fatty acids, fats and oils, lipids of biological importance

3.3 Amino acids – essential and non-essential amino acids, peptide bond formation

3.4 Proteins- overview of proteins synthesis, structural organization, functions of proteins

3.5 Nucleic acids- structure and functions of DNA and RNA.

3.6 Enzymes: role as biological catalysts,Mechanism of enzyme action, Industrial applications of enzymes

Unit 4: Human Anatomy

4.1 General Anatomy- Basic terms in anatomy- Anterior, posterior, lateral, medial, Elementary tissues of the human body

4.2 Cardiovascular system, Respiratory System

4.3 Gastrointestinal System, Genito-urinary system

4.4 Musculoskeletal system, Nervous system& Sense organs

4.5 Endocrine System

Unit 5: Human Physiology

5.1 Body fluids and salts, composition and functions of blood, Blood groups, blood clotting

5.2 Cardiac cycle and heart sounds, Electrocardiogram (ECG), Blood pressure, Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure and cardiac arrhythmias

5.3 Respiratory volumes and capacities, Hypoxia, Asphyxia

5.4 Disorders of GIT, Endocrine disorders

5.5 Microbial infections, Cancer

Unit 6: Genetics & Computational Approach to Biology

6.1 Genetics- DNA as a blueprint and RNA as a messenger, from DNA sequence to Genes (From alphabets to words), Mendelian Inheritance

6.2 DNA to Chromosomes- Genes and Mutations, Information pathways – Replication, Transcription and Translation, Epigenetic Modifications.

6.3 Computational Approach to Biology- Finding a needle in the haystack – Making sense of the Big Data,Types of Biological Datasets.

6.4 The "Omics" Approach, Introduction to Network Biology - Basics of Graph and Network Theory, Cellular Networks.

Text/ Reference Books:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wileyand Sons

3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company

4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman andcompany, Distributed by Satish Kumar Jain for CBS Publisher

5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering the entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each Unit). Students need to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional-I 30%

Sessional-II 30%

Assignment/Tutorial 20%

Class Work/ Quiz 20%

Course Articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BBT-100.1	2	1	1	-	-	1	1	-	-	-	3	2				
BBT-100.2	3	2	2	-	-	2	2	-	-	-	3	3				
BBT-100.3	3	3	3	-	-	3	3	-	-	-	3	3				
BBT-100.4	3	3	3	-	-	3	3	-	-	-	3	3				

MANAV RACHNA INTERNATIONAL INSTITUE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCH-151A: CHEMISTRY LAB

Periods/week	Credits	Max. Marks	: 100
P: 2	1	Continuous Evaluation	: 50
Duration of Examination: 2 Hrs		End Semester Examination	: 50

Pre-requisite: Basic knowledge of 10+2 level Chemistry

Course Type: Basic Sciences Courses

Course Outcomes: The students will be able to:

BCH-151A.1. analyze the need and utility of the experiments.

BCH-151A.2. do precise quantitative measurements using volumetric glassware, analytical balance, and prepare standards solutions independently.

BCH-151A.3. carry out experiments to check the hardness, alkalinity and chloride content of different water samples and interpret the results.

BCH-151A.4. employ the basic methods/techniques to measure surface tension, viscosity, conductance, emf, saponification value of different samples.

List of Experiments:

1. Preparation and standardization of volumetric solutions.
2. Determination of viscosity using Ostwald Viscometer.
3. Determination of hardness of water by EDTA method.
4. Determination of alkalinity of water.
5. Determination of strength of solution by Conductometric titration.
6. Determination of Ferrous ion concentration using Potentiometer.
7. Determine the percentage composition of given mixture of sodium hydroxide and sodium chloride.
8. Determination of viscosity of lubricating oils using Redwood viscometers.
9. Determination of chloride content of water.
10. Determination of surface tension using Stalagmometer.
11. Determination of saponification value of oils.
12. Determination of the partition coefficient of a substance between two immiscible liquids.

Text Books/ Reference books/Web references:

1. Sunita Rattan, 2011, **Experiments in Applied Chemistry**, S.K.Kataria& sons.

2. Shailendra K.Sinha,2014, Physical Chemistry A Laboratory Manual, Alpha Science International Limited.

3. https://vlab.amrita.edu/index.php?sub=2&brch=190

4.https://vlab.amrita.edu/index.php?sub=2&brch=193&sim=575&cnt=1

Instructions for Exam: One experiment out of 10 given randomly needs to be performed in exams.

Distribution of Continuous Evaluation:

Viva-I	30%
Viva-II	30%
File/Records	20%
Class Work/ Performance	20%

Evaluation Tools:

Experiments in lab

File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BCH-151A.1	3	3	2	1	1	-	1	1	1	1	-	2
BCH-151A.2	3	3	2	1	2	-	1	1	1	1	-	2
BCH-151A.3	3	3	2	1	2	-	2	1	1	1	-	2
BCH-151A.4	3	3	2	1	1	-	1	1	1	1	-	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-151: ENGLISH LAB

(Humanities and Social Sciences including Management Courses)

Periods/week	Credits	Max. Marks: 100
L: 0 T:0 P:2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hours		End Semester Examination: 50

Prerequisites: Basic knowledge of English language

Course Type: HSMC

Course Outcomes:

BHM-151.1. Students would be able to speak in English confidently.
BHM-151.2. To develop the understanding of correct pronunciation and intonation.
BHM-151.3. Students would be able to communicate professionally in a corporate environment.

List of Activities

1. Listening exercises for correct pronunciation and intonation
2.Role plays for speaking confidently

1. Group Discussions
2. Extempore
3. Mock Interviews
4. In Class Presentations
5. JAM Sessions
6. Theatre activity

Text Books/Reference Books:

1. Liz Hamp-Lyons and Ben Heasly, 2006, Study Writing, Cambridge University Press.
2. Sanjay Kumar and PushpLata, 2011, Communication Skills,. Oxford University Press.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Instructions for Exam: Every student needs to complete 5activities in a semester. One activity out of 5 randomly needs to be performed in exams.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BCH-MC-002: ENVIRONMENTAL SCIENCE(EVS)

Periods/week Max. Marks: 100

T: 1 Continuous Evaluation : 50

End Semester Examination : 50

Pre-requisite: Basic knowledge of Environment related issues

Course Type: Mandatory

Pre-requisite: Basic knowledge of Environment related issues

Course Type: Mandatory

Course Outcomes : The students will be able to

BCH-MC-002.1: comprehend various environmental issues through various activities.

BCH-MC-002.2: understand that each and every action of ours reflects on the environment and collaborate in groups to suggest innovative ways to protect environment through project work/report writing.

Activities:

i) Small group meetings about conservation and management of natural resources, conservation of biodiversity, solid waste management and environmental remediation

ii) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural

iii) Expert talk

iv) Sloganwriting/Poster making event

v) Cycle rally to create awareness on issues like pollution control, cleanliness, and waste management.

vi)Plantation activity

vii) Cleanliness drive

viii) Drive for segregation of waste

ix)Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

x) Environment protection related efforts

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

The break-up for marks

Continuous Evaluation Marks

Evaluation based on participation in activities: 50 marks

External Marks

Field work, Report writing & Viva: 20+20+10 = 50 marks

Course Articulation Matrix

CO Statement (BCH-MC-002)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BCH-MC-002.1	1	2	1	-	-	2	3	2	1	-	-	1	-	-	-	-
BCH-MC-002.2	1	2	1	-	-	2	3	2	1	-	-	1	-	-	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-101A: PROGRAMMING FOR PROBLEM SOLVING

Periods/week	Credits	Max. Marks : 200
L :3 T: 0	3.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Pre-Requisite: Basic Knowledge of Computers

Course Type: Program Core

Course Outcomes: The students will be able to-

BCS-101A.1. Formulate simple algorithms for arithmetic and logical problems with correct logic.
BCS-101A.2. Implement the conditional statement and ietration with understanding of concepts.
BCS-101A.3. Decompose a problem into functions and able to understand use of functions.
BCS-101A.4. Apply advance C programming techniques such as arrays, pointers, dynamic memory allocation, structures to develop solutions for particular problems.

PART- A

Unit-1: Introduction to Programming

3.1 Introduction to programming
3.2 Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
3.3 Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples.
3.4 From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.
3.5 Expressions, Precedence and Associatively, Expression Evaluation, Type conversions

Unit-2: Loops and Conditional Statements

2.1 Arithmetic expressions and precedence
2.2 Conditional Branching; Writing and evaluation of conditionals and consequent branching
2.3 Iteration and loops

Unit-3: Arrays and Structures

3.1 Arrays (1-D, 2-D):1 D array and function–Passing individual array elements to a function,
3.2 passing individual array elements address to a function,

3.3 passing whole 1d array to a function, 2D array and function,
3.4 Passing individual array elements to a function, passing individual array elements address to a function,
3.5 passing whole 2d array to a function
3.6 Character Arrays and Strings
3.7 Structures; Defining Structures
3.8 Array of Structures

PART –B

Unit-4: Functions

4.1 Functions (including using built in libraries)
4.2 Parameter passing in functions
4.3 call by value.
4.4 Passing arrays to functions: idea of call by reference
4.5 Recursion, as a different way of solving problems.
4.6 Example programs, such as Finding Factorial, Fibonacci series.

Unit-5: Basic Algorithms

5.1 Iterative Searching (Linear and Binary Search)
5.2 Basic Sorting Algorithms with implementation (Bubble, Insertion and Selection)
5.3 Finding roots of equations
5.4 Notion of order of complexity through example programs (no formal definition required)

Unit-6: Pointers and File Handling

6.1 Idea of pointers, Defining pointers,Pointer to an array,
6.2 Array of pointers,Pointers and two dimensional arrays
6.3 Use of Pointers in self-referential structures
6.4 Notion of linked list (no implementation)
6.5 File Handling :Working with text files and Binary Files,
6.6 File operations using std. library and system calls–File management I/O functions

Text Books / Reference Books:

1. Byron Gottfried, 2015, Schaum's Outline of Programming with C: 2nd Ed., McGraw-Hill.
2. E. Balaguruswamy, 1998, Programming in ANSI C: 2nd Ed., Tata McGraw-Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language:, 2nd Ed., PHI.

Software required/Weblinks:

Turbo C

www.tutorialpoint.com

www.nptel.com

www.w3schools.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Quiz	20%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX :

CO Statement (BCS-101A)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
BCS-101A.1	2	3	2	-	2	-	-	-	-	-	-	3	1	1	-
BCS-101A.2	2	1	2	1	3	-	-	-	-	-	-	-	-	1	1
BCS-101A.3	-	1	2	-	1	2	-	-	-	-	-	1	3	2	1
BCS-101A.4	3	3	1	3	2	-	-	-	-	-	-	-	3	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-151A: PROGRAMMING FOR PROBLEM SOLVING LAB

Periods/week	Credits	Max. Marks :100
P :2	1.0	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-Requisite: Programming for problem solving (BCS-101A)

Course Type: Program Core

Course Outcomes: Students will be able to-

BCS-151A.1. Formulate the algorithms for simple problems in C language.
BCS-151A.2. Understanding of syntax errors as reported by the compilers as well as logical errors.
BCS-151A.3. Write iterative as well as recursive programs,implementing of arrays, strings and structures and various graph traversing algorithms.
BCS-151A.4. Declare pointers of different types and able to understand the concept of file handling.

NOTE: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

List of Practicals:

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value,call by refrence

Lab 7: Simple functions

Tutorial 8: Recursion, structure of recursive calls

Lab 8: Recursive functions

Tutorial 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 9: Programming for solving Numerical methods problems

Tutorial 10: Pointers, structures and dynamic memory allocation

Lab 10: Pointers and structures

Tutorial 11: File handling

Lab 11: File operations

Software required/Weblinks:

Turbo C

www.tutorialpoint.com

www.nptel.com

www.w3schools.com

Note: At least 5 more exercises to be given by the teacher concerned.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	20%

Evaluation Tools:

Experiments in lab

File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

COURSE ARTICULATION MATRIX :

CO Statement (BCS-151A)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-151A.1	2	1	2	2	-	-	-	-	-	-	2	1	2	-	1
BCS-151A.2	3	-	-	3	2	-	-	-	-	-	-	-	2	3	3
BCS-151A.3	3	1	2	3	-	1	-	-	-	-	-	-	1	2	-
BCS-151A.4	2	3	1	2	3	-	-	-	-	-	1	1	3	2	-

SEMESTER 3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-301A: ELECTRONIC DEVICES

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination: 100

Pre-requisites: BPH-104: Physics
Course Type: Program Core

Course Outcomes
The students will be able to:
BEC-DS-301.1. Apply semiconductor physics for analyzing performance of diode and transistor.
BEC-DS-301.2. Implement various applications of diode.
BEC-DS-301.3. Analyze bipolar junction transistor under different biasing arrangements along with the operation of BJT and FET
BEC-DS-301.4. Design regulated power supply.

PART-A

Unit 1: Introduction to Semiconductor Physics

1.1 Review of Quantum Mechanics, Electrons in periodic Lattices
1.2 E-k diagrams, Energy bands in intrinsic and extrinsic silicon
1.3 Carrier transport:diffusion current, drift current
1.4 Mobility and resistivity, sheet resistance, design of resistors

Unit 2: Semiconductor-Diode Characteristics

2.1Generation and recombination of carriers, Poisson and continuity equation
2.2 Bond structure of semiconductors, intrinsic and extrinsic semiconductors
2.3 P-N junction characteristics, I-Vcharacteristics, Diode breakdown: Avalanche and Zener
2.4 Zener diode, Schottky diode,LED, photodiode and solar cell

Unit 3: Applications of Diode
3.1 Rectifiers: Half wave rectifier: The analysis of average current, Average voltage, Peak Inverse voltage, Ripple factor and Efficiency
3.2 Full wave rectifiers: Center tapped and Bridge rectifier: The analysis of average current, Average voltage, Peak Inverse voltage, Ripple factor and Efficiency, Numerical based on rectifiers
3.3 Filters Circuits: Inductor filters with half wave and full wave rectifier, Capacitor filters with Half wave and Full wave rectifiers, L-Section filter and Π-Section filter
3.4 Voltage regulation using Zener diode
3.5 Diode Clipping & Clamping Circuits: Positive, Negative series and shunt circuit
3.6 Peak to peak detector circuit, Voltage multipliers

PART-B

Unit 4:Bipolar Junction Transistor

4.1The junction transistor, Transistor current components, Transistor as an amplifier,Ebers-Moll Model
4.2 Transistor construction,Detailed study of currents in a transistor, Transistor operating regions
4.3 Common base configuration, Common emitter configuration, Common collector configuration

4.4 Transistor Biasing: The operating point, Bias stability
4.5 Collector to base bias, Emitter feedback bias, Collector-emitter feedback bias
4.6 Self bias stabilization against variations in V_{BE} and I_B for self bias circuit
4.7 Bias compensation, Thermistor and Sensistor compensation
4.8 Thermal runaway, Thermal stability

Unit 5: Field Effect Transistor
5.1 Introduction to FET, JFET-n channel & p channel: construction, working and its V-I characteristics
5.2 Introduction to MOSFET,MOS capacitor, C-V characteristics
5.3 Depletion and Enhancement MOSFET - n channel & p channel: construction, working and its V-I characteristics
5.4 Small signal model of MOS transistor
5.5 Comparison of BJT, JFET and MOSFET
5.6 FET as a VVR

Unit 6: Regulated power supplies

6.1 Elements of a regulated power supply system, Stabilization
6.2 Emitter follower regulator, Series voltage regulation
6.3 Monolithic linear regulators
6.4 Performance parameters of 3-terminal IC regulators
6.5 Shunt voltage regulators

Text Books/Reference Books:

1.G. Streetman and S. K. Banerjee , 2014, Solid State Electronic Devices , 7th edition, Pearson.
2.: D. Neamen , D. Biswas , Semiconductor Physics and Devices, McGraw-Hill Education
3S. M. Sze and K. N. Kwok, 2006, Physics of Semiconductor Devices , 3rd edition, John Wiley &Sons,
4.C.T. Sah , 1991, Fundamentals of solid state electronics, World Scientific Publishing Co. Inc,.
5.Y. Tsividis and M. Colin, 2011, Operation and Modeling of the MOS Transistor, Oxford Univ.Press.

Software Required/Weblinks:

Transistor Amplifier Circuit Designer Software
PSPICE, ORCAD
nptel.ac.in/courses/117103063/31
nptel.ac.in/courses/117103063/30

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-301)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O 2	PS O 3	PS O 4
BEC-DS-301.1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-301.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	1	-
BEC-DS-301.3	3	3	3	2	2	-	-	-	-	-	-	2	3	2	1	-
BEC-DS-301.4	3	3	3	2	2	-	-	-	-	-	-	2	3	2	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-302: DIGITAL ELECTRONICS

Periods/week	Credits	Max. Marks: 200
L: 3 T: 0	3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Course Type: Program Core

Course Outcomes

The students will be able to:

BEC-DS-302.1. Explain the fundamentals of digital electronics such as logic gates, coding techniques etc.

BEC-DS-302.2. Optimize the combinational logic circuits by applying different minimization techniques.

BEC-DS-302.3.Compare various A/D and D/A conversion techniques by analyzing their performance parameters for different applications.

BEC-DS-302.4. Classify various logic families and implement basic logic gates based on these logic families.

PART-A

Unit 1: Fundamentals of Digital Logic Circuits

1.1 Digital Signal, Number System, Conversion of Bases
1.2 Codes: BCD code, Excess-3 code, Gray code and Alpha-numeric code
1.3 Binary & BCD Arithmetic, Boolean algebra
1.4 Logic Gates, Concept of Universal Gates
1.5 Error Detection and Correction: Parity Method, Hamming Code Method

Unit 2: Logic Simplification and Combinational Logic Design

2.1 Review of Boolean Algebra and De Morgan's Theorem,
2.2 SOP & POS forms, Canonical forms,
2.3 Boolean expression minimization techniques: K-Map(up to 6 variables), Quine Mccluskey Method
2.4 Design of Combinational Circuits using ROM, PAL ,PLA and FPGA

Unit 3: MSI Devices

3.1 Digital Comparator, Multiplexer, De-multiplexer, Encoder, Decoder
3.2 Half and Full Adders, Subtractors, Serial and Parallel Adders,
3.3 BCD Adder, Barrel shifter and ALU
3.2 Driver and multiplexed display

PART-B

Unit 4: Sequential Logic Design

4.1 Combinational v/s Sequential Circuit, Latch v/s Flip-Flop
4.2 Types of Flip-Flops: S-R, J-K, D & T, Excitation Table of Flip Flops, Toggling & Race around Condition
4.3 Master Slave Flip-Flop
4.4 Shift Registers & Types: SISO, SIPO, PISO and PIPO
4.5 Bidirectional Shift Register, Universal Shift Register

4.6 Counter & Types: Ripple Counter, Decade Counter, Ring and Johnson Counter

Unit 5: A/D and D/A Converters

5.1 Requirement and Specification of A/D and D/A Converters
5.2 Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistorstring etc.
5.3 Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.
5.4 Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Unit 6: Digital Logic Families

6.1 Unipolar and Bipolar Logic Families, Characteristics of Digital ICs
6.2 Bipolar Logic Families: Tristate TTL and ECL
6.3 Unipolar Logic Families: NMOS, PMOS, CMOS
6.4 Interfacing between TTL and CMOS
6.5 Memory elements

Text Books/ Reference Books:

1. William H. Gothmann, 2006, Digital Electronics: An Introduction To Theory And Practice: , 2nd Edition, PHI Learning.
2.M. Morris Mano, Michael D Ciletti, 2008, Digital Design , 4th Edition, Pearson.
3. Thomas L. Floyd, R. P. Jain, 2005,Digital Fundamentals:, 8th Edition, Pearson.
4.D.V. Hall , 1989, Digital Circuits and Systems, Tata McGraw Hill.
5. John Morris, 1992,Digital Electronics, 1stEdition,Routledge.
6. Digital Systems: Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss,2009, 10thEdition, Pearson.

Software required/Weblinks:
nptel.ac.in/courses/117101055

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-302)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-302.1	2	1	1	-	1	1	-	-	-	-	-	1	3	1	3	1
BEC-DS-302.2	3	2	3	1	2	2	-	-	-	-	-	1	3	2	3	1
BEC-DS-302.3	3	1	2	-	1	1	-	-	-	-	-	-	3	2	3	1
BEC-DS-302.4	3	1	2	-	1	1	-	-	-	-	-	-	3	2	3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-303A: SIGNALS AND SYSTEMS

Periods/week		Credits		Max. Marks	: 200
L: 3	T: 0	3		Continuous Evaluation	: 100
Duration of Examination: 3 Hrs				End Semester Examination:	100

Course Type: Program Core

Course Outcomes
The students will be able to

BEC-DS-303.1. Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
BEC-DS-303.2. Understand the concepts of continuous time and discrete time systems
BEC-DS-303.3. Analyze system properties based on impulse response and Fourier analysis.
BEC-DS-303.4. Apply the Laplace transform for analysis of continuous-time signals and systems and analyse systems in complex frequency domain.

PART-A

Unit 1: Introduction to Signals

1.1 Classification of Signals: Continuous & Discrete, Analog & Digital, Periodic & Aperiodic, Even & Odd, Energy & Power, Causal & Anti-Causal, Random & Deterministic
1.2 Elementary Signals (Continuous & Discrete: Unit Impulse, Unit Step and Ramp)
1.3 Manipulations on Discrete Time Signals: Time Scaling, Time Shifting, Folding, Addition, Multiplication

Unit 2: Introduction to Systems

2.1 Classification of Systems: Linear & Non-Linear, Time-Variant & Time-Invariant, Causal & Non-Causal, Static & Dynamic, Stable & Unstable
2.2 Numericals on System Classification
2.3 Linear Time Invariant (LTI) Systems: Concept of impulse response & Discrete Convolution

Unit 3: Laplace Transform

3.1 Introduction, Region of Convergence (ROC) of Laplace Transform, Laplace Transform of some standard signals
3.2 Properties of Laplace transform&its proof: Linearity, Time Shifting, Frequency Shifting,TimeScaling, Time Reversal, Differentiation in frequencydomain
3.3 Convolution, Correlation, Initial & Final value theorem
3.4 Inverse Laplace Transform
3.5 Numericals on Laplace transform and its inverse

3.6 Analysis of LTI systems using Laplace transform

PART-B

Unit 4: Fourier Series

4.1 Definition, Dirichlets conditions
4.2 Trigonometric Fourier series, Exponential/Complex Fourier Series
4.3 Parseval's identity for Fourier series
4.4 Power spectrum of a periodic signal

Unit 5: Fourier Transform

5.1 Introduction, Fourier Transform of some standard signals
5.2 Properties of Fourier transform&its proof: Linearity, Time Shifting, Frequency Shifting, Modulation, Time Scaling, Time Reversal, Duality, Differentiation in frequencydomain, Convolution, Correlation
5.3 Parseval's Power Theorem, Rayleigh's Energy Theorem
5.4 Numericals on Fourier Transform

Unit 6: Discrete Time Fourier Transform (DTFT)

6.1 Introduction, DTFT of some standard signals
6.2 Properties of DTFT & its proof: Linearity, Time Shifting, Frequency Shifting, Modulation, Time ScalingTime Reversal, Duality, Differentiation in frequencydomain
6.3 Convolution, Correlation
6.4 Parseval's Power Theorem
6.5 Numericals on Discrete Time Fourier Transform

Text Books/ Reference Books:

1. Digital Signal Processing, Principles, Algorithms and Applications: John G. Proakis and Dimitris G. Manolakis , 3rd Edition, PHI, 2000.
2. Digital Signal Processing: Salivahanan, Vallavaraj and Gananapriya, 2nd Edition, TMH, 2001.
3. Signals and Systems: Simon Haykin and Barry Van Veen, 2nd Edition, John Wiley, 1999.
4. Linear Systems and Signals: B. P. Lathi, 2nd Edition, Oxford University Press, 2005.

Software required / Web links:

MATLAB
nptel.ac.in/courses/117101055
http://nptel.ac.in/courses/117104074

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-303)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-303.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-303.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-303.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-303.4	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-

MANAV INSTITUTE RACHNA INTERNATIONAL OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-301: DATA STRUCTURES & ALGORITHMS

Periods/week	Credits	Max. Marks	: 200
L :3 T: 1	4.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Sem Examination	: 100

Pre-Requisite: Basic Knowledge of computers

Course Type: Program Core

Course Outcomes: Students will be able to-

BCS-DS-301.1. Define the concepts of data structures, searching, sorting and their complexity
BCS-DS-301.2. Understand the structured data types and their applications
BCS-DS-301.3. Apply the data structures to real life problems of sorting, searching, traversal
BCS-DS-301.4. Analyze the complexity of different data structures operations, sorting and searching
BCS-DS-301.5. Evaluate the different sorting algorithms in best, average and worst case scenarios
BCS-DS-301.6. Design the best solution for real life problems using various data structures

PART-A

Unit 1: Introduction

1.1 Basic Terminologies: Elementary Data Organizations, Data Structures
1.2 Operations: insertion, deletion, traversal
1.3 Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off
1.4 Searching: Linear Search and its complexity analysis
1.5 Binary Search Techniques and its complexity analysis

Unit 2: **Linked Lists**

2.1 Singly linked lists: Representation in memory
2.2 Algorithms of several operations: Traversing, Searching
2.3 Insertion into, Deletion from linked list
2.4 Doubly linked list: operations on it and algorithmic analysis
2.5 Circular Linked Lists: all operations their algorithms and the complexity analysis
2.6 Header linked List and Header nodes

Unit 3: Stacks and Queues

3.1 ADT Stack and its operations

3.2 Applications of Stacks: Expression Conversion
3.3 Evaluation of Infix, prefix and Postfix Expression – corresponding algorithms and complexity analysis
3.4 Queues: Definition, Implementation of Linear Queues and Its Operations
3.5 Circular Queue, Priority Queues and Its Implementation
3.6 Linked representation of Stack and Queue
3.7 Queue Algorithms and their analysis
3.8 Applications of queues

PART-B

Unit 4: Trees

4.1 Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree
4.2 Binary Search Tree and its operations with complexity analysis
4.3 AVL Tree and its operations with complexity analysis
4.4 B Tree, B+ Tree: definitions, algorithms and analysis
4.5 Applications of Binary Trees

Unit 5: Graph

5.1 Basic Terminologies and Representations
5.2 Graph Traversals Algorithms: Breadth First and Depth First
5.3 Minimum Spanning Trees(Prim's and Kruskal's Algorithm)
5.4 complexity analysis of Graphs

Unit 6: Sorting and Hashing

6.1 Objective and properties of different sorting algorithms: Selection Sort
6.2 Bubble Sort, Insertion Sort
6.3 Quick Sort
6.4 Merge Sort, Heap Sort
6.5 Performance and Comparison among all the methods
6.6 Hashing

Text Books/ Reference Books:

1. Tenenbaum, A.M., 1990. Data structures using C. Pearson Education India.
2. Horowitz Ellis & Sartaj Sahni,1983. Fundamentals of Data Structures, Galgotria Pub
3. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D.,1999. Data Structures and Algorithms, Addison Wesley
4. Jean Paul Tremblay, Richard B. Bunt, 2002, Introduction to Computers Science -An algorithms approach,T.M.H.
5. Ryba, A.J. and Kruse, R.L.K., 2007. Data structures and program design in C++. Prentice Hall.

Software required/Weblinks:

Turbo C

www.tutorialpoint.com

www.nptel.com

www.w3schools.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

End Semester Examination

Course Articulation Matrix:

CO Statement (BCS-DS-301)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-DS-301.1	3	3	2	3	3	3	1	1	2	2	2	2	2	2	2
BCS-DS-301.2	3	3	3	3	2	3	1	2	2	2	1	2	2	2	2
BCS-DS-301.3	3	2	3	3	3	3	1	1	2	2	1	2	2	2	2
BCS-DS-301.4	3	3	3	3	3	3	1	1	2	3	1	2	2	3	2
BCS-DS-301.5	3	2	3	2	3	2	2	1	2	3	1	2	2	3	2
BCS-DS-301.6	3	3	3	3	3	3	2	2	2	3	2	2	2	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEE-DS-301: ELECTRICAL CIRCUIT ANALYSIS

Periods/week Credits	Max. Marks : 200
L: 3T: 1 4	Continuous Evaluation: 100
Duration of Examination: 3 Hours	End Semester Examination: 100

PreRequisite: Basic Electrical Engineering
Course Type: Program Core

Course Outcomes: After completion of this course the students will be able to
BEE-DS-301.1 Solve electrical networks using different theorems and Graph theory.
BEE-DS-301.2 Analyze the transient and steady state behavior of electrical circuits.
BEE-DS-301.3Analyze the effect of location of poles and zeros on time domain behavior and calculate the two-port network functions and parameters.
BEE-DS-301.4Design the Constant-K passive filters.

Unit 1: NETWORK THEOREMS (8 Hours)
1.1 Superposition theorem, Thevenin theorem
1.2 Norton theorem, Maximum power transfer theorem, Compensation theorem.
1.3 Analysis with independent and dependent current and voltage sources.
1.4 Node and Mesh Analysis.
1.5 Concept of duality and dual networks.

Unit 2: ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS (7 HOURS)
2.1 Review of Laplace Transform, inverse Laplace transform
2.2 Circuit representation in s-domain,
2.3 Types of signals
2.4 Wave form synthesis
2.5 Analysis of electrical circuits (RL, RC, RLC) using Laplace Transform for standard inputs.

Unit 3: NETWORK FUNCTIONS (7 HOURS)
3.1 Network Functions, terminal pairs or ports
3.2 Network functions for one-port and two-port networks
3.3 Transfer function- impedance and admittance function
3.4 Poles and zeros of Network functions
3.5 Restrictions on pole and zero locations for driving point functions and transfer functions
3.6 Effect of Pole-Zero location on Time domain behavior.

Unit 4: TWO PORT NETWORK PARAMETERS (6 HOURS)
4.1 Relationship of two-port variables short-circuit admittance parameters
4.2 Open circuit impedance parameters
4.3 Transmission parameters, Hybrid parameters
4.4 Relationships between parameter sets
4.5 Theorem and condition of reciprocity & symmetry
4.6 Inter-connection of two port networks.

Unit 5: FILTERS (6 HOURS)
5.1 Image Parameters and characteristics impedance
5.2 Filter fundamentals

5.3 Analysis of k derived high-pass, low-pass, band-pass and band-reject filters
5.4 Design of constant k low pass and high pass filters
5.5 Analysis of m -derived low pass and high pass filters.

Unit 6: GRAPH THEORY (6 HOURS)
6.1 Graph of a network definitions
6.2 Incidence matrix, Reduced Incidence matrix
6.3 Loop matrix, cut set matrix
6.4 Interrelation among various matrices
6.5 Mesh and Nodal solutions from tie set & cut set matrix.

Text Books/ Reference Books:

1. A Chakrabarti, 2018, Circuit Theory Analysis and Synthesis, DhanpatRai&Co.
2. Ashfaq Husain, 2015, Networks and Systems, Khanna Publishers.
3. D. Roy Choudhary, 2013, Networks and Systems, New Age International Publications.
4. M Nahvi , Joseph Edminister, K Rao,2017, Electric Circuits, (Schaum's Outline Series), McGraw Hill Education.
5. Samarajit Gosh,2005, Network Theory- Analysis and Synthesis, PHI learning.
6. W. H. Hayt and J. E. Kemmerly, 2013, Engineering Circuit Analysis, McGraw Hill Education.

Software required/Weblinks:
MATLAB
http://nptel.ac.in/courses/10810242/2
https://www.tutorialspoint.com/gate.../pdf/gate

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

S Sessional- I	30%
S Sessional- II	30%
A Assignment	20%
C Class Performance	10%
At Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BEE-DS-301.1	1	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-
BEE-DS-301.2	2	2	3	2	-	-	-	-	1	-	-	1	2	-	1	2
BEE-DS-301.3	2	-	2	-	1	-	-	-	-	-	-		2	-	1	-
BEE-DS-301.4	2	2	3	-	-	1	-	-	-	-	-	1	3	-	-	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BHM-001A: CYBER LAW & ETHICS

Periods/week Credits	Max. Marks	: 200
L :3 T: 0 2.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Semester Examination	: 100

Course Type: HSMC

Course Outcomes: The students will be able to-
BHM-001A.1 understand Networking basics and the various networking utilities and various addressing schemes used in Networking.
BHM-001A.2 Understand the importance of information security and also the various threats posed to it.
BHM-001A.3 Identify the various Internet frauds and various types of attacks faced by a Network.
BHM-001A.4 Understand the various cyber laws, ethics, privacy rights and its impact over society.
BHM-001A.5 Understand the various Information Technologies Acts and the intellectual property rights.

PART – A

Unit 1: Networks and the Internet

1.1 Introduction to Network Basics,
1.2 General Architecture of Internet,
1.3 IP Addresses.
1.4 Uniform Resource Locators and their role,
1.5 Basic Network Utilities, IP Config, Ping, Tracert.

Unit 2: Introduction to Computer Security

2.1 Importance of Information and its Security,
2.2 Types of Threats: Malware, Denial of Service Attacks, Web Attacks, Session Hijacking, DNS Poisoning;
2.3 Basic Security Terminology.

Unit 3: Cyber Attacks

3.1 Introduction to Internet Frauds, Phishing, Cyber Stalking, Types of Attacks: Investment Offers, Auction Frauds, Identity Theft,
3.2 Protecting Yourself against Cyber Crime, Protecting against Investment Fraud, Protecting against Identity Theft,
3.3 Secure Browser Settings.
3.4 cyber laws and their scope and coverage,

PART – B

Unit 4: Computer and its impact in Society

4.1. Need for Cyber Law in 21st century
4.2. Development of Cyber Law in India

Unit 5: Privacy Issue and Access Rights

5.1. Introduction to Cyber Ethics
5.2. Freedom of Speech and Expression in Cyber Space
5.3. Right to Privacy and Right to Data protection

5.4. Cyber Security Audit

Unit 6: Information and Technology Act & Intellectual Property Rights

6.1. Historical Background and objectives
6.2. Legal Recognition of Electronic Record & Procedure
6.3. Offences and Penalties.

Text Books / Reference Books:

1. William Easttom2011, Computer Security Fundamentals, 2nd ed, Pearson
2. Dr. Pramod Kr. Singh, 2007, Laws on Cyber Crimes, Book Enclave, Jaipur
3. Mark. F. Grady and Francesco Parisi, 2006,The Law and Economics of Cyber Security, Cambridge University Press

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BHM-001)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BHM-001A.1	3	2	1	-	-	-	-	-	--	-	-	-	3	2	3	2
BHM-001A.2	-	-	2	-	-	-	-	-	1	-	-	2	2	2	3	1
BHM-001A.3	-	-	-	-	-	-	3	-	2	1	-	-	2	1	2	1
BHM-001A.4	-	-	-	-	3	2	-	-	-	2	2	1	2	3	3	2
BHM-001A.5	-	-	2	-	-	-	-	1	-	-	1	-	3	2	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-351: ELECTRONIC DEVICES LAB

Periods/week Credits	Max. Marks : 100
P: 2 1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs	End Semester Examination : 50

Co- requisites: BEC-DS-301: Electronic Devices

Course Type: Program Core

Course Outcomes

The students will be able to:
BEC-DS-351.1. Analyze the operation and characteristics of P-N Junction diode and Zener diode.
BEC-DS-351.2. Realize amplifier circuits using bipolar junction transistor and calculate their parameters.
BEC-DS-351.3. Develop the various biasing circuits of bipolar junction transistor.
BEC-DS-351.4. Design an RC coupled Amplifier and evaluate its frequency response.

LIST OF EXPERIMENTS:

1. To verify the V-I Characteristics of Semiconductor Diode.
2. To verify the V-I characteristics of Zener diode & its application as Voltage regulator.
3. To design a rectifier circuit using diode and calculate ripple factor, efficiency and regulation.
4. To design a clipper circuit using diode.
5. To design a clamper circuit using diode.
6. To design a dc voltage Doubler using diode.
7. To plot the input and output characteristics of transistor in common Base /common emitter configuration.
8. To design a buffer using transistor in Common Collector configuration.
9. To design a BJT fixed bias circuit with and without emitter resistor.
10. To plot the V-I characteristics of JFET and to find its parameters (dynamic resistance (r_d), transconductance (g_m), amplification factor(μ)).
11. To plot the V-I characteristics of MOSFET.
12. To Design and measure the frequency response of an RC coupled amplifier using discrete components.
13. To Design a two stage RC coupled amplifier and determine the effect of cascading on gain and bandwidth.
14. To Design and verify IC voltage regulator.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Design a Full wave Rectifier.
2. Design a fixed Power Supply (5V and 12 V).
3. Design a Function Generator (Square wave and Triangular wave).
4. Design Astable Multivibrator.
5. Design of RC Coupled Amplifier.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-351)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-351.1	3	3	2	2	3	-	-	-	-	-	-	2	3	2	1	-
BEC-DS-351.2	3	3	2	3	3	-	-	-	-	-	-	2	3	2	1	-
BEC-DS-351.3	3	3	2	2	3	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-351.4	3	3	3	2	3	-	-	-	-	-	-	2	3	2	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-352: DIGITAL ELECTRONICS LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-302: Digital Electronics
Course Type: Program Core

Course Outcomes

The Students will be able to:

BEC-DS-352.1. Demonstrate the operations of various TTL gates.
BEC-DS-352.2. Apply K map minimizing procedures for circuit realization and compare the original and minimized circuits.
BEC-DS-352.3. Interpret the functioning of different combinational circuits and sequential circuits with the help of flip-flops by relating the outputs of these IC's with the truth tables.
BEC-DS-352.4. Describe the functioning of logic gates based on extensively used CMOS logic family.

List of Experiments:

1. To verify the truth tables of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. To design and realize a given function using K maps & using its performance.
3. To verify the operation of multiplexer and demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T and D type flip flops.
6. To verify the operation of bi-directional shift register.
7. To design and verify the operation of 3 bit synchronous counter.
8. To design the operation of a ring counter.
9. To design the operation of a Johnson counter.
10. To design and verify the operation of a- synchronous UP / DOWN decade counter using J-K Flip flops.
11. To design and verify the operation of synchronous UP / DOWN decade counter using J-K Flip flops.
12. To design and realize a sequence generator for a given sequence using J-K flip flops.
13.To understand the working of CMOS NAND & NOR gates & interfacing between TTL and CMOS gates.
14. Design a 4-bit shift register and verify its operation.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Design various logic gates using transistor
2. Design and verify the operation of 2 bit synchronous counter using JK flip flops
3. Design a binary to gray code converter using gates
4. Design visitor counter using BCD to 7 segment Display
5. Design and verify the operation of logic gates using Multiplexer

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-352)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-352.1	3	1	2	1	1	-	-	-	-	-	-	2	3	3	1	3
BEC-DS-352.2	3	2	3	3	2	-	-	-	-	-	-	2	3	3	2	3
BEC-DS-352.3	3	2	3	3	2	-	-	-	-	-	-	2	3	3	2	3
BEC-DS-352.4	3	1	3	2	2	-	-	-	-	-	-	2	3	3	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-351: DATA STRUCTURES & ALGORITHMS LAB

Periods/week	Credits	Max. Marks	:	100
P :2	1.0	Continuous Evaluation	:	50
Duration of Examination: 2 Hrs		End Semester Examination	:	50

Co-Requisite: Data Structures & Algorithms (BCS-DS-301)

Course Type: Program Core

Course Outcomes: Students will be able to-

BCS-DS-351.1. Define the iterative and recursive approach

BCS-DS-351.2. Understand the various Data structures using C

BCS-DS-351.3. Deploy the advance C programming techniques such as pointers, dynamic memory allocation, and structures to developing solutions for particular problems

BCS-DS-351.4. Analyze various operation performed on elementary data structures

BCS-DS-351.5. Select the appropriate data structures based upon problem environment

BCS-DS-351.6. Design the solutions for the real-world problems

List of Practicals:

1. (a) Write a program to find factorial of a number through iterative method.
   (b) Write a program to find factorial of a number through recursion.
2. (a) Write a program to print the Fibonacci series through iterative method.
   (b) Write a program to print the Fibonacci series through recursion.
3. (a) Write a program to find an element in linear array using linear search.
   (b) Write a program to find an element in multi-array using linear search.
4. (a) Write a program to find an element in linear array using Binary search(Iterative).

   (b) Write a program to find an element in linear array using Binary search(Recursive).
5. Write a program to implement stack data structures statically and perform the following functions:

a) Insertion b) Deletion c) Traversing

6. Write a program to convert infix notation to postfix notation using stack (application of stack).

7. Write a program to evaluate infix notation using stack (application of stack).

8. Write a program to implement linear queue data structures statically and perform the following functions:

    a) Insertion b)Deletion c)Traversing

7. Write a program to implement circular queue data structures statically and perform the following functions:
    a) Insertion b) Deletion c)Traversing
8. Write a program to implement dequeue(double ended queue)data structures statically. Ask from user for the type of dequeue to be implemented and call the functions accordingly.
9. Write a program for a menu-driven program that enable user to implement linked-list with all possible operations:
    a) Insertion at end b)Insertion at beginning c)Insertion at Specified Position
    d) Deletion at end e) Deletion at beginning f)Deletion at Specified Position
    g) Traversing h) Counting the nodes
10. Write a program for a menu-driven program that enable user to implement circular linked-list with all possible operations:
    b) Insertion at end b)Insertion at beginning c)Insertion at Specified Position
    e) Deletion at end e) Deletion at beginning f)Deletion at Specified Position
    h) Traversing h) Counting the nodes
11. Write a program for a menu-driven program that enable user to implement doubly linked-list with all possible operations:
    c) Insertion at end b)Insertion at beginning c)Insertion at Specified Position
    f) Deletion at end e) Deletion at beginning f)Deletion at Specified Position
    i) Traversing h) Counting the nodes
12. Write a program for various tree traversal algorithms (Pre, Post, In order) using two dimensional representations for trees.
13. Write a program to simulate BFS graph traversing algorithms.
14. Write a program to simulate DFS graph traversing algorithms.
15. Write a program to implement MST using Prim's Algorithms
16. Write a program to implement MST using Kruskals's Algorithms
17. Write a Program to sort data using
    a) Selection Sort
    b) Insertion Sort
    c) Bubble Sort
    d) Quick Sort
    e) Merge Sort
    f) Heap Sort

Software required/Weblinks:

Turbo C

www.tutorialpoint.com

www.nptel.com

www.w3schools.com

Note: At least 5 more exercises to be given by the teacher concerned.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Experiments in lab

File work/Class Performance
Viva (Question and answers in lab)
End Semester Practical Examination

COURSE ARTICULATION MATRIX :

CO Statement (BCS-DS-351)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
BCS-DS-351.1	3	3	3	3	3	3	1	1	2	2	2	2	2	2	2
BCS-DS-351.2	3	3	3	3	3	3	1	2	2	2	1	2	2	2	2
BCS-DS-351.3	3	3	3	3	3	3	2	1	2	2	1	2	2	2	2
BCS-DS-351.4	3	3	3	3	3	3	1	2	2	2	1	2	2	3	2
BCS-DS-351.5	3	3	3	3	3	3	2	2	2	2	1	2	2	3	2
BCS-DS-351.6	3	3	3	3	3	3	2	2	2	3	2	2	2	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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DTI -300: Design, Thinking and Innovation-I

Periods/week	Credits	Max. Marks	: 50
L:0 T:1 P:0	1	Continuous Evaluation	: 50

Pre-requisites: Nil
Course Type: Research & Training
Course Coordinator: Mr. Yaman Hooda

Course Outcomes:
DTI300.1. To explore different sources for generating ideas for Research.
DTI300.2.To understand the problem classification based on domain specific resources.
DTI300.3. To realize the design thinking stages.
DTI300.4. Topresent critical analysis of literature survey.

Activity 1: Motivation

1.1 Divergent thinking and brain storming
1.2 Creative process

Activity 2: Introduction to Design Thinking

2.1 Empathize Mode
  2.1.1 Discussions and deliberations
2.2 Define Mode
2.3 Ideate Mode
  2.3.1Contemporary Relevance.
  2.3.2 Tools and techniques for generating ideas
  2.3.3 Idea Challenges

Activity 3: Problem Classification

3.1 Domain Classification.
3.2 Identification of Mentors

Activity 4: Problem identification

4.1 Literature survey and option analysis.
4.2 Feasibility study.
4.3 Formulation of problem statement.
4.4Expected Outcome / Model of the problem.
4.5 Planning Matrix

Activity5: Presenting the Ideation

5.1 Structuring and preparation of PPT
5.2 Review on presentation skills and content delivered
5.3 Incorporating the review comments.

Course Articulation Matrix:

CO Statement (DTI-300)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
DTI 300.1	1	2	-	-	1	-	2	3	3	3	2	2	-	3
DTI 300.2	2	3	-	-	2	3	3	2	2	2	2	3	3	-
DTI 300.3	3	3	1	2	3	2	2	3	2	-	-	2	2	2
DTI 300.4	3	3	1	2	3	3	2	3	3	-	2	2	3	-

'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

S. No:	Parameters	Description	Marks	
1.	**Attendance**	Percentage of classes attended by the students	**5**	**5**
2.	**Continuous Performance**	Group participation and response of the students to a given task:		**15**
		Judge individual student in the group	**5**	
		Meeting timelines as per activity plan	**10**	
3.	**Literature Review**	Student interaction with faculty mentors	**5**	**15**
		Relevance of the topic	**3**	
		Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc.	**2**	
		Number of relevant papers / design referred for the given topic	**5**	
4.	**PPT & Report**	Report structure and Slide sequence	**5**	**15**
		Contribution of individual group member towards the presentation and report	**5**	
		Scientific/Technical writing	**5**	
		Max. Marks	**50**	**50**

References:

1. http://nptel.ac.in/courses/121106007/
2. http://public.wsu.edu/~taflinge/research.html

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BHM-MC-004:QUANTITATIVE APTITUDE

Periods/week Credits	Max. Marks : 100
L:0 T:0 P :2 AP	Continuous Evaluation : 50
Duration of Examination: 2 Hrs	End Semester Examination :50

Course Outcomes:

BHM-MC-004.1. Students will be able to recognize problems based on arithmetic & number system.
BHM-MC-004.2. Students will be able to solve problems based on verbal reasoning & simplification.
BHM-MC-004.3. Students will be able to calculate the correct answers to the problems within given time.
BHM-MC-004.4. Students will be able to plan their career meticulously by setting their time oriented goals.
BHM-MC-004.5. Students will be able to introspect and enhance their personality.
BHM-MC-004.6. Students will be able to develop cultural sensitivity and communicate respectfully across cultures.

PART – A

Unit 1: Number System 1

1.1 Vedic Mathematics
- 1.1.1 Basic of mathematics
- 1.1.2 Addition and subtraction using Vedic Mathematics
- 1.1.3 Multiplication of two and three numbers.

1.2 Simplification
- 1.2.1 BODMAS rule
- 1.2.2 Fractions and recurring decimals
- 1.2.3 Surds and indices

1.3 Numbers
- 1.3.1 Types of numbers and number tree
- 1.3.2 Divisibility Rule
- 1.3.3 HCF & LCM

Unit 2: Verbal Reasoning 1

2.1 Direction Sense Test
2.2 Blood Relation Test

Unit 3: Arithmetic 1

3.1 Problem on Ages
3.2 Problem on Numbers
3.3 Averages

Part B

Unit 4: Career Planning

4.1 **Career planningProcess** - Self Assessment, Research, Decision Making, Action and Employability
4.2 **Goal Setting:** Relevance, SMART goals, The Dos & Don'ts

Unit 5: Personality Enhancement

5.1 **Emotional Intelligence:** Emotional Self -Awareness, Self- Control, Emotional Management
5.2 **Stress Management:** What is Stress, Types of Stress, Stress Response Example, Vulnerability to Stress, Why do we Stress out, Stress Warning Symbols, Suggestions for Reducing Stress,
5.3 **Time Management:** Setting Priorities, Managing Time, Four Quadrants of Time Management
5.4. **Team Building:** Definition –Team, Characteristics of effective Teams, Competence, Clear and Compelling goal, Supportive Environment, Alignment, Designing the Team, Identifying Roles and Responsibilities, Determining Reward, Troubleshooting Guide, Good Team member

Unit 6: Effective Communication

6.1 **Courtesy in Communication:** Being Polite, Self -Discipline, Respecting Others and understanding other's perspective in communication
6.2 **Inter cultural Communication:** Breaking Stereotypes, Diversity Inclusion and Cultural Sensivity

Text Books/Reference Books:

1. R S Aggarwal ,2017, Quantitative Aptitude for Competitive Examinations, S Chand & Company Pvt Ltd
2. R S Aggarwal ,2018, A Modern Approach to Verbal & Non Verbal Reasoning, S Chand & Company Pvt Ltd
3. Mark A Griffin ,College to Career: The Student Guide to Career and Life Navigation
4. Anthony Gutierez, Effective Communication in the Workplace

Instructions for paper setting: Fifty MCQ will be set in total. TwentyFiveMCQ will be set from Part A and Twenty Five MCQ will be set from Part B. All questions will be compulsory. Each question will be of 1 mark. There will be no negative marking. Calculator will not be allowed.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (BHM-MC-004)	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO 1	PSO 2	PSO 3	PSO 4
BHM-MC-004.1	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
BHM-MC-004.2	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2
BHM-MC-004.3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	2
BHM-MC-004.4	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	1
BHM-MC-004.5	-	-	-	-	-	-	-	1	3	3	-	1	-	-	-	2
BHM-MC-004.6	-	-	-	-	-	-	-	1	2	3	-	1	-	-	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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PROJ-EC-300A: SUMMER INTERNSHIP

Periods/week	Credits	Max. Marks : 50
4 weeks	1	Continuous Evaluation : 50

Duration of Examination: 2 Hrs

Course Outcomes:
The students will be able to:

Proj-EC-300.1. Analyze the real working environment and get acquainted with the organizational structure, business operations and administrative functions.
Proj-EC-300.2. Apply subject knowledge to related fields so that they can relate and reinforce what has been taught at the university.
Proj-EC-300.3. Develop synergetic collaboration between industry and the university.
Proj-EC-300.4. Demonstrate the role of the professional/specialist/manager/supervisor confidently in the relevant industry.
Proj-EC-300.5. Explore options in their career plans and make a gradual transition from academia to career.

Session-1- Introduction to Scilab

1.1 How to install Scilab
1.2 Scilab environment
1.3 Importing data from Excel
1.4 Visualizing data
1.5 Basic data processing
1.6 Useful commands and help

Session-2 – Become familiar with Scilab and Programming

3.1 The general environment and the console
3.2 5 Simple numerical calculations
3.3 The menu bar
3.4 The editor
3.5 The graphics window
3.6 Windows management and workspace customization
3.7 Variables, assignment and display
3.8 Loops Tests

Session-3– Useful Scilab functions

3.1 2 and 3D plots
3.2 Supplements on matrices and vectors
3.3 Calculation accuracy
3.4 Solving differential equationsIn analysis In probability and statistics

3.5 To display and plot Utilities

Session-4- Scilab Arduino Blinking LED Project

4.1 Configuration/Arduino Setup

4.2 Installation & Set-- up

4.3 Simulation/Acquisition of the signal

Session-5- Temperature monitoring with Scilab/Xcos and Arduino

5.1 Configuration/Arduino Setup

5.2 Hardware Set-- up

5.3 Scilab--side script for temperature acquisition

Distribution of Continuous Evaluation:

Presentation/Viva	40%
Report	20%
Class Work/ Performance	20%
Attendance	20%

Course Articulation Matrix

CO Statement (Proj-EC-300)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
Proj-EC-300A.1	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
Proj-EC-300A.2	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
Proj-EC-300A.3	3	3	2	3	3	2	2	3	3	3	3	2	3	3	3	3
Proj-EC-300A.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
Proj-EC-300A.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-201: IoT DESIGN WITH ARDUINO

Periods/week	Credits	Max. Marks : 200
L: 3 T: 0	3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination: 100

Course Type: Core

Course Outcomes
The students will be able to:

BEC-DS-201.1 Analyze the configuration of Internet of things (IoT) based architecture.
BEC-DS-201.2. Apply microcontroller platforms to perform varying and complex tasks.
BEC-DS-201.3. Analyze the knowledge learnt and apply it to solve real world problems.
BEC-DS-201.4. Identify devices for IoT configuration

PART-A

Unit 1: Introduction to IoT

1.1 Introduction to Internet and computing devices
1.2 Introduction to concept of IoT devices
1.3 IoT configurations
1.4 Basic components: Hardware and software requirements
1.5 Basics of Networking
1.6 Introduction to embedded systems

Unit 2: Introduction to Microcontroller and Arduino

2.1 Introduction to Microcontroller
2.2 ATMEGA328 Architecture
2.3 ATMEGA328 Pin Diagram & Internal Registers
2.4 Introduction to Arduino
2.5 Arduino architecture
2.6 Types of Arduino boards
2.7 Base Structure of Arduino Programming
2.8 Arduino standard libraries and contributed libraries

Unit 3: Fundamentals of Arduino Programming

3.1 Introduction to Embedded C
3.2 Variables, data types and Functions,
3.3 Logical & Math Operations
3.4 Control Statements
3.5 Loops
3.6 Operation with digital and analog pins

PART-B

Unit 4: Real World Interfacing Applications

4.1 Introduction to Sensors and its types
4.2 Arduino Interfacing with sensors: IR, LDR, Ultrasonic, PIR, Temperature sensor
4.3 Arduino Interfacing with Motor
  4.3.1 DC motor interfacing with Arduino
  4.3.2 Stepper motor interfacing with Arduino
  4.3.3 Servo motor interfacing with Arduino
4.4 16x2 LCD interfacing with Arduino
4.5 Bluetooth module interfacing with Arduino
4.6 DHT11 sensor interfacing with Arduino
4.7 Relay Interfacing with Arduino
4.8 DS1307 RTC module interfacing with Arduino

Unit 5: Networking using Arduino

5.1 Cloud and its services
5.2 Fundamentals of IoT networking protocols: MQTT, TCP, CoAP, UDP
5.2 Understanding features of Thingspeak cloud
5.3 Fundamentals of ESP8266 WiFi module
5.4 Interfacing ESP8266 WiFi module with Arduino
5.5 Ethernet Shield Interfacing with Arduino
5.6 Overview of Node MCU board for IoT design applications
5.7 Security aspects in IoT

Unit 6: IoT Case Studies using Arduino

6.1 Industrial Automation
6.2 Transportation
6.3 Agriculture
6.4 Healthcare
6.5 Home Automation

Text Books/ Reference Books:

1. Massimo Banzi, O'Reilly Media, 2011, Getting Started with Arduino, ISBN – 9781449309879.
2. Adrian McEwen, Hakim Cassimally, John Wiley & Sons, 2013, Designing the Internet of Things, ISBN 9781118430620.
3. TeroKarvinen, KimmoKarvinen, Ville Valtokari, 2014, Make Sensors: A Hands-On Primer for Monitoring the Real World with Arduino and Raspberry Pi, Maker Media Inc.,ISBN – 9781449368067.
4. Pradeeka Seneviratne, 2015, Internet of Things with Arduino Blueprints, Packt publishing.
5. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Elsevier.
6. Jeeva Jose, "Internet of things", Khanna Publishing House, Delhi.
7. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill.

Software required / Web links:

https://www.tutorialspoint.com/internet_of_things/index.htm
https://www.arduino.cc/en/Main/Software
https://www.raspberrypi.org/
https://www.python.org/
https://github.com/iot-lab/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-201)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-201.1	2	2	2	1	2	-	-	1	-	-	2	2	3	2	2	-
BEC-DS-201.2	3	2	2	1	2	1	-	1	-	1	1	2	3	1	1	-
BEC-DS-201.3	2	3	2	3	2	3	2	1	-	1	2	2	2	3	2	1
BEC-DS-201.4	2	2	3	2	3	2	3	1	2	1	2	2	3	3	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-251 IOT DESIGN WITH ARDUINO LAB

Periods/week	Credits	Max. Marks	:100
P :2	1	Continuous Evaluation	: 50
Duration of Examination: 2 Hrs		End Semester Examination	: 50

Course Type: Core

Course Outcomes:

The students will be able to:

BEC-DS-251.1. Perform experiments using Arduino Board
BEC-DS-251.2. Interface various peripherals using Arduino Board
BEC-DS-251.3.Understand the significance of serial communication
BEC-DS-251.4. Analyse the importance of cloud in Internet of Things and develop a project based on IoT

List of Experiments:

1. Familiarization with Arduino environment and installation of Arduino IDE.
2. To interface LED/Buzzer with Arduino and to write a program to turn LED/Buzzer ON for 1 sec after every 2 sec.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino and write a program to turn ON the LED when push button is pressed or at sensor detection.
4. To interface LM35 temperature sensor with Arduino and print the temperature reading on serial port.
5. To interface DC motor with Arduino and write a program to turn ON the motor when push button is pressed.
6. To interface HC05 bluetooth module with Arduino and write a program to send the temperature sensor data to smart phone using Bluetooth.
7. To interface HC05 bluetooth with Arduino and write a program to turn the LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program to upload temperature and humidity data on Thingspeak cloud.
9. Write a program on Arduino to publish temperature data to MQTT broker.
10. Write a program on Arduino to subscribe to MQTT broker for receiving the temperature data and print it.
11. To interface 16x2 LCD with Arduino and write a program to print "Welcome" on LCD.
12. To perform SPI and I2C communication between two Arduino boards.
13. To interface DS1307 RTC chip with Arduino and control onboard LED using RTC time.
14. To interface servo motor with Arduino board.
15. To interface stepper motor with Arduino board.
16. To interface OLED with Arduino board and write a program to print the temperature and humidity readings on it.

Projects:

1. Smart Phone Controlled Robot
2. Smart Home.

3. Wearable gadget for remote monitoring of heart rate and ECG.

Instructions for Exam: Every student needs to complete 10 experiments in a semester. One experiment out of 10 given randomly needs to be performed in exams.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (BEC-DS-251)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**	**PS O4**
BEC-DS-251.1	3	2	1	2	1	1	2	2	2	2	1	2	-	-	-	-
BEC-DS-251.2	1	1	1	2	-	-	1	2	2	2	1	1	-	-	-	-
BEC-DS-251.3	3	2	1	2	1	2	2	2	2	2	1	2	-	-	-	-
BEC-DS-251.4	1	-	2	2	-	-	1	2	2	2	1	1	-	-	-	-

SEMESTER 4

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-401A: COMMUNICATION ENGINEERING

Periods/week Credits	Max. Marks : 200
L: 3 T: 1 4	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Program Core

Course Outcomes

The students will be able to:

BEC-DS-401A.1: Describe the basic concepts of Communication systems.
BEC-DS-401A.2: Analyze and compare different analog modulation schemes for their efficiency and bandwidth
BEC-DS-401A.3: Investigate pulsed modulation system and analyze their system performance
BEC-DS-401A.4: Analyze different digital modulation schemes and can compute the bit error performance
BEC-DS-401A.5 Analyze the behavior of a communication system in presence of noise

PART-A

Unit 1: Introduction to Communication Systems

1.1 Elements of Communication system & its fundamental Limitations
1.2 Frequency spectrum of EM waves, Need for modulation
1.3 Types of modulation
1.4 Bandwidth and information capacity
1.5 Types and Applications of Communication Systems

Unit 2: Amplitude Modulation Systems

2.1 Basics of Amplitude modulation
2.2 Power relations in the AM
2.3 Square law modulator, Switching modulator, Square law demodulator, Envelope Detector
2.4 Double side band suppressed carrier modulation, Balanced and Ring Modulators
2.5 Coherent demodulator, Single side band modulation,
2.6 Frequency Discrimination and Phase Discrimination modulators
2.7 Coherent detection of SSB, VSB modulation & demodulation

Unit 3: Angle Modulation Systems

3.1 Basics of Frequency and phase modulation
3.2 Single tone and multi tone frequency modulation, NBFM, WBFM
3.3 Transmission bandwidth of FM wave
3.4 Indirect and direct methods of FM generation
3.5 Frequency Discriminator
3.6 Phase Locked Loop demodulator

3.7 Ratio Detector

PART-B

Unit 4: Pulse Modulation

4.1Sampling theorem, aliasing,
4.2Aperture effect, type of pulse analog modulation: PAM, PWM and PPM
4.3Generation and demodulation, comparison of PAM, PWM and PPM.
4.4PCM, quantization process, companding
4.5Probability of error for PCM systems
4.6DPCM, delta, adaptive delta modulation.

Unit 5: Digital Modulation Techniques

5.1Basic digital band pass modulation schemes
5.2 ASK, PSK, QAM, FSK schemes
5.3M-ary PSK modulation and demodulation
5.4Differential PSK modulation and demodulation,
5.5Spread-spectrum communication system, direct sequence SS system,
5.1 Frequency hopped SS system, applications of SS system, PN sequence.

Unit 6: Noise

6.1Introduction to noise
6.2 Types, internal and external sources of noise
6.3Thermal noise, short noise, noise figure
6.4Noise temperature, equivalent noise bandwidth
6.5 Calculation of noise for cascaded networks.

Text Books/ Reference Books:

1. Simon Haykin, 2004, Communication Systems, 4th Edition, John Wiley & Sons.
2. B.P.Lathi, 2009, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press.
3. Herbert Taub, Goutam Saha and Donald L. Schilling, 2015, Principles of Communication Systems , 3rd Edition, Tata McGraw Hill.
4. Wayne Tomasi,2004, Electronic Communications Systems, Fundamentals Through Advanced, 5th Edition, Pearson Education.
5. George Kennedy, 2012, Electronic Communication Systems, 5th Edition, Tata McGraw Hill.
6. John G.Proakis, 2001, Communication Systems Engineering, 2nd Edition, Pearson

Software Required/Weblinks:

MATLAB
http://nptel.ac.in/courses/117102059/
http://nptel.ac.in/courses/117105077/
http://www.nptelvideos.in/2012/11/communication-engineering.html
http://textofvideo.nptel.iitm.ac.in/117102059/lec12.pdf

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-401A)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-401A.1	3	3	2	2	1	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-401A.2	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-401A.3	3	3	2	2	3	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-401A.4	3	3	2	2	3	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-401A.5	3	3	2	2	3	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-402: ANALOG CIRCUITS

Periods/week Credits	Max. Marks	: 200
L: 3 T: 0 3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Semester Examination	: 100

Pre-requisites: BEC-DS-301: Electronic Devices
Course Type: Program Core

Course Outcomes
The students will be able to
BEC-DS-402.1. Demonstrate the working of transistor as an amplifier at low and high frequency.
BEC-DS-402.2. Demonstrate the applications of Field effect transistor.
BEC-DS-402.3. Analyze the concept of single stage amplifiers.
BEC-DS-402.4. Design various power amplifier circuits.

PART-A

Unit 1: Small Signal Analysis
1.1 Low frequency transistor models,
1.2 Estimation of voltage gain, input resistance, output resistance etc.
1.3 Design procedure for particular specifications,
1.4 Low frequency analysis of multistage amplifiers.

Unit 2: Transistor frequency response at High frequency
2.1 High frequency transistor models
2.2 Frequency response of single stage and multistage amplifiers
2.3 Cascade amplifier
2.4 Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues

Unit 3: Feedback Topologies
3.1 Types: Voltage series, current series, voltage shunt, current shunt,
3.2 Effect of feedback on gain, bandwidth etc., calculation with practical circuits
3.3 Concept of stability, gain margin and phase margin.

PART-B

Unit 4: Oscillators
4.1 Review of the basic concept, Barkhausen criterion
4.2 RC oscillators(phase shift, Wien bridge etc.)
4.3 LC oscillators (Hartley, Colpitt, Clapp etc.)
4.4 Non-sinusoidal oscillators
4.5 Current mirror: Basic topology and its variants, V-I characteristics
4.6 Output resistance and minimum sustainable voltage (VON), maximum usable load.

Unit 5: Differential amplifier

5.1Basic structure and principle of operation
5.2 Calculation of differential gain, common mode gain, CMRR and ICMR
5.3 OP-AMP design: design of differential amplifier for a given specification

5.4 Design of gain stages and output stages, compensation.

Unit 6: OP-AMP applications

6.1 Review of inverting and non-inverting amplifiers
6.2 Integratorand differentiator, summing amplifier, precision rectifier
6.3 Schmitt trigger and its applications
6.4 Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text Books/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, 1992,Introduction to Operational Amplifier theory and applications, McGraw Hill.
2. J. Millman and A. Grabel, 1988, Microelectronics , 2nd edition, McGraw Hil.
3. P. Horowitz and W. Hill , 1989, The Art of Electronics , 2nd edition, Cambridge University Press.
4. A.S. Sedra and K.C. Smith ,Microelectronic Circuits,Edition IV, Saunder's College11 Publishing.
5. Paul R. Gray and Robert G.Meyer,,Analysis and Design of Analog Integrated Circuits, 3rd Edition, John Wiley

Software Required/ Weblinks:

Transistor Amplifier Circuit Designer Software
PSPICE, ORCAD
nptel.ac.in/courses/117103063/31
nptel.ac.in/courses/117103063/30

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-402)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-402.1	3	3	2	2	2	2	2	2	2	2	2	2	3	1	2	-
BEC-DS-402.2	3	3	2	2	2	2	2	2	3	2	2	2	3	2	1	-
BEC-DS-402.3	3	3	3	2	2	2	2	2	2	2	2	2	3	2	1	-
BEC-DS-402.4	3	3	3	3	2	2	2	3	2	2	2	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-403: MICROPROCESSORS & MICROCONTROLLERS

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination: 100

Pre-requisites: BEC-DS-302 Digital Electronics
Course Type: Program Core

Course Outcomes

The students will be able to
BEC-DS-403.1. Identify the main function and application of microprocessor and microcomputers.
BEC-DS-403.2. Describe the architecture of 8 bit, 16 bit microprocessor and 8051 microcontroller.
BEC-DS-403.3. Demonstrate the concept of memory and Peripherals Interfacing with microprocessor and microcontroller.
BEC-DS-403.4. Apply Instruction set to develop microprocessor and microcontroller based applications
BEC-DS-403.5. Illustrate the functioning of various timers and Interrupts of 8051 microcontroller.

PART-A

Unit 1: Introduction to 8085 Microprocessors

1.1 Evolution of Microprocessors, Comparison of microprocessors and microcontrollers
1.2 Architecture of 8085 microprocessor, Pin configuration, Signal description and De-multiplexing of address data lines, Addressing modes, Instruction set, Timing diagram of MOV, MVI, IN and OUT Instructions
1.3 Interrupt structures

Unit 2: 8086 Architecture

2.1 Architecture of 8086 microprocessor
2.2 Concept of BIU and EU, Pin configuration, Signal description and De multiplexing of address data lines
2.3 Pipelining, Memory segmentation and Memory banking
2.4 Minimum mode and Maximum mode configurations, Interrupt structure
2.5 Introduction to Co-processor 8087

Unit 3: Instruction Set and Assembly Language Programming

3.1 Addressing modes of 8086 microprocessor, Instruction format
3.2 Instructions of 8086 microprocessor: Data transfer Instructions, Arithmetic Instructions, Logical Instructions
3.3 String Manipulation Instructions, Control Transfer Instructions, Processor control Instructions, BCD Instructions
3.4 Programming examples, Assembler directives and operators, Timing diagrams

PART-B

Unit 4: Introduction to 8051

4.1 Introduction to 8051 microcontroller
4.2 Architecture
4.3 Addressing modes
4.4Instruction set of 8051

Unit 5: Timers& Interrupts

5.1 Various timers and registers of 8051 microcontroller
5.2 Various modes of operation of timers
5.3 Various interrupt codes of 8051
5.4 Simple programming examples

Unit 6: Serial Interface

6.1 Introduction to serial interface
6.2 SCON and SBUF registers, generation of control word
6.3 Various modes of operation of serial interface
6.4 Serial port baud rates
6.5 Use of Timer1 as baud rate clock generator
6.6 Simple programming examples like interfacing with LCD.

Text Books/ Reference Books:

1. Ramesh S. Gaonker,2011, Microprocessor Architecture, Programming & Applications with 8085, 5th Edition, Wiley.
2.Barry B. Brey, 2009, The Intel Microprocessors 8086/Pentium Processors, 8th Edition, Pearson Prentice Hall.
3. Mohammad Ali Mazidi, Janice GillispieMazidi and Rolin McKinlay, 2007, 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson Education.
4.I. Scott Mackenzie and Raphael C. W. Phan, 2008, The 8051 Microcontroller, 4th Edition, Pearson Education.

Software required/Weblinks:
8085 Simulator
EMU-8086
Keil µVision 4
nptel.ac.in/courses/117104072
http://nptel.ac.in/downloads/106108100/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-403)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-403.1	1	1	1	1	2	-	-	-	-	-	-	2	1	2	-	-
BEC-DS-403.2	1	1	2	1	3	-	-	-	-	-	-	2	2	3	-	-
BEC-DS-403.3	1	2	3	3	3	-	-	-	-	-	-	3	2	3	-	-
BEC-DS-403.4	2	2	3	3	3	-	-	-	-	-	-	3	2	3	-	-
BEC-DS-403.5	1	2	2	3	3	-	-	-	-	-	-	2	2	3	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-404A: ELECTROMAGNETIC WAVES

Periods/week Credits	Max. Marks: 200
L: 3 T: 0 3	Continuous Evaluation: 100
Duration of Examination: 3 Hrs	End Semester Examination: 100

Pre requisites: BSC-PH-104: Physics
Course Type: Program Core
INDUSTRY SUPPORT: Microwave, Optical, and Antennas

Course Outcomes
The student will be able to:

BEC-DS-404.1. Understand the basic physical concepts related to electromagnetic vector fields.
BEC-DS-404.2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
BEC-DS-404.3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.
BEC-DS-404.4. Apply Maxwell's equations and their application to time-harmonic fields, boundary conditions, wave equations, and Poynting's theorem.
BEC-DS-404.5. Solution of problems relating to transmission lines with time-harmonic excitation and uniform plane wave propagation.

PART- A

Unit 1: Coordinate Systems and Transformation

1.1 Various coordinate systems (Cartesian, Cylindrical, Spherical)
1.2 Unit vectors in coordinate systems
1.3 Concept and physical interpretation of gradient, divergence and curl
1.4 Integral Theorems: Divergence theorem, Stokes theorem

Unit 2: Electrostatics

2.1 Coulomb's law and field intensity, Electric field due to discrete charges, Electric field due to continuous charge distribution
2.2 Electric scalar potential, Relationship between potential and electric field, Potential due to infinite uniformly charged line, Potential due to electric dipole, Electric flux density
2.3 Gauss law, proof and applications of Gauss Law
2.4 Poisson's and Laplace's equation
2.5 Uniqueness theorem, Capacitance, electrostatic energy and energy density
2.6 Boundary conditions for electric fields, Method of images

Unit 3: Magnetostatics

3.1 Biot-Savart's law
3.2 Magnetic field intensity due to a finite and infinite wire carrying current
3.3 Magnetic field intensity on the axis of a circular and rectangular loop carrying a current

3.4 Ampere's circuital law and its applications, Magnetic flux density, Ampere's force law
3.5 Magnetic scalar and vector potentials, Inductors and Inductances
3.6 Magnetic energy, Magnetic boundary conditions

PART-B

Unit 4: Maxwell's Equations

4.1 Faraday's law, Displacement current, Equation of continuity for time varying fields
4.2 Inconsistency of Ampere's law
4.3 Maxwell's equations in Integral and Differential forms
4.4 Time Harmonic Fields, Poynting theorem, Poynting vector and flow of power, Instantaneous, average and complex Poynting vectors

Unit 5: Electromagnetic Waves

5.1 Wave equation for free space (or lossless medium)
5.2 Uniform plane wave propagation, Relation between E and H in uniform plane wave
5.3 Wave equation for conducting medium, Wave propagation in lossy and lossless dielectrics, Conductors and dielectrics
5.4 Wave propagation in good dielectric and good conductor
5.5 Depth of penetration, Linear, elliptical and circular polarization, Reflection of plane waves at normal incidence, Surface impedance

Unit 6: Transmission Lines

6.1 Transmission line parameters, Transmission line equations
6.2 Input impedance (for lossy, lossless line), Propagation constant
6.3 Phase constant and attenuation constant
6.4 Characteristic impedance, Open and short circuited lines
6.5 Standing wave and reflection losses, Impedance matching, Introduction to Smith chart

Text Books/ Reference Books:

1. Matthew N.O.Sadiku, 2009, Principles of Electromagnetics ,4th Edition, Oxford University Press.
2. K.D.Prasad, 1988, Electromagnetic Theory, 6th Edition, SatyaPrakashan.
3. William H.Hayte, John Buck, 1983, Engineering Electromagnetics, 8th Edition, McGraw Hill.
4. Edward Conrad Jordan, Keith George Balman, 2007, Electromagnetic Waves and Radiating Systems, 2nd Edition, Prentice-Hall.

Software Required/Weblinks:

http://nptel.ac.in/courses/117103065/1- 117103065/55

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-404)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-404.1	3	3	3	1	-	-	-	-	-	-	-	-	2	2	1	-
BEC-DS-404.2	2	3	2	2	-	-	-	-	-	-	-	-	2	2	1	-
BEC-DS-404.3	3	3	3	1	-	-	-	-	-	-	-	-	-	2	1	-
BEC-DS-404.4	3	2	2	1	-	-	-	-	-	-	-	-	2		3	-
BEC-DS-404.5	2	2	3	2	2	-	-	-	2	-	-	-	2	2	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

NAAC 'A' Grade University

BCS-DS-302A: OBJECT ORIENTED PROGRAMMING

Periods/week Credits	Max. Marks	: 200
L :2 T: 1 3.0	Continuous Evaluation	: 100
Duration of Exam: 3 Hrs	End Sem Examination	: 100

Pre-Requisite: Basic Knowledge of computers

Course Type: Program Core

Course Outcomes: Students will be able to -

BCS-DS-302A.1. Define the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.

BCS-DS-302A.2. Understand dynamic memory management techniques using pointers, constructors, destructors, etc

BCS-DS-302A.3. Identify the concept of function overloading, operator Overloading, Virtual Functions and Polymorphism.

BCS-DS-302A.4. Categorize inheritance with the understanding of early and late binding, usage of exception handling, generic programming

BCS-DS-302A.5. Implement File Handling and stream file operations using Functions and their corresponding pointers also learn to handle errors in File handling.

BCS-DS-302A.6. Create the Template and Exception and Demonstrate concepts and functionalities of Try, Catch blocks and handle exceptions using throw and re-throw

PART A

Unit-1: Object Oriented Concepts

1.1. Procedure Oriented programming,
1.2. Introduction to Object Oriented Programming; Basic Concepts of OOPs: Class, Object, Data Abstraction, Encapsulation (Information Hiding),
1.3. Access modifiers: public, protected, private, package.
1.4. Polymorphism, Overloading; Inheritance, Reusability,
1.5. Dynamic Binding, Message Passing,
1.6. Benefits of OOPS concept,
1.7. Applications of OOP,
1.8. A simple C++ program, keywords, datatypes (basic, user-defined, derived)

Unit–2: Classes and Objects

2.1 Introduction to classes and objects.
2.2 Class Scope, Accessing class members: Variables and Methods.
2.3 Initializing class objects with constructors.
2.4 Default and Parameterized Constructor.
2.5 Constants variables and constant member functions.
2.6 Objects as members of class, Abstract Class.
2.7 friend function
2.8 Dynamic Memory Allocation.
2.9 Static Class Members, Proxy Classes, Destructors

Unit-3: Polymorphism

3.1 Concept of polymorphism.

3.2 function overloading

3.3 Constructor Overloading,

3.4 Operator overloading, Restrictions on Operator Overloading, Overloading operators: <<, >>, Unary Operators, Overloading Binary Operators.

3.5 Operator overloading using friend function.

3.6 Operator Functions as Class Members versus Friend Functions,

PART B

Unit-4: Inheritance

4.1 Introduction to Inheritance, Base Classes and Derived Classes.
4.2 Types of inheritance,
4.3 virtual function, Pure Virtual function,
4.4 Abstract base classes: Use of virtual functions in classes.
4.5 Pointer to derived class,
4.6 Use of Protected and Private Inheritance and Member Functions.
4.7 Overriding Base Class Members in a Derived Class,
4.8 Use of Constructors and Destructors in derived Classes,
4.9 Implicit Derived Class Object to Base Class Object Conversion,
4.10 Composition versus Inheritance.

Unit-5: File Handling

5.1 Introduction of file handling, Classes and file stream operations,
5.2 Creating sequential files, reading and writing files,
5.3 Opening and closing of file, detecting the end of file.
5.4 File Modes: sequential and random file modes.
5.5 File pointers and their manipulations,
5.6 Sequential input and output operations,

5.7 Updating a file: sequential and random access files,
5.8 Error handling during file operations.

Unit-6: Templates & Exception Handling

6.1 Function Templates, Overloading Function Template,

6.2 Class Template, Class Templates and Non-Type Parameters,

6.3 Templates and Inheritance, Templates and Friend classes, Templates and Static Members,

6.4 Introduction of Exception Handling, Exception Handling mechanisms: Try, Throw, Catch.

6.5 Throwing an Exception, Catching an Exception,

6.6 Re-throwing an Exception, Exception specifications,

6.7 Processing Unexpected Exceptions,

6.8 Use of exceptions in inheritance.

Text Books / Reference Books:

1. Robert Lafore, 2001, object Oriented Programming in Turbo C++, 4^{th} Ed., Pearson Education.
2. E Balagurusamy, 2013, Object oriented Programming with C++, 6^{th} Ed., TMH.
3. Horstmann, 2008, Computing Concepts with C++ Essentials, 2^{nd} Ed., John Wiley.
4. Bhave, 2012, Object Oriented Programming in C++, 2^{nd} Ed., Pearson.
5. D Ravichandran, 2003, Programming with C++, 3^{rd} Ed., TMH.
6. Herbert Schildt, 2005, The Complete Reference in C++, 4^{th} Ed., TMH.

Software required/Weblinks:

C/C++ (TurboC/DOS BOX)
www. 3schools.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

End Semester Examination

COURSE ARTICULATION MATRIX :

CO Statement (BCS-DS-302)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
BCS-DS-302A.1	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-
BCS-DS-302A.2	-	1	3	-	1	-	-	-	-	-	-	-	-	-	-
BCS-DS-302A.3	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-
BCS-DS-302A.4	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-
BCS-DS-302A.5	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
BCS-DS-302A.6	-	-	2	3	3	2	3	-	-	-	-	2	2	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-451: COMMUNICATION ENGINEERING LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-401A: Communication Engineering
Course Type: Program Core

Course Outcomes
Students will be able to :

BEC-DS-451.1 Evaluate analog modulated waveform in time/frequency domain and also to find its modulation index.
BEC-DS-451.2. Contrast between various digital modulation techniques.
BEC-DS-451.3. Demonstrate various pulse modulation techniques.
BEC-DS-451.4. Examine various multiplexing techniques and its importance in practical world.
BEC-DS-451.5. Implement different data formatting techniques.

LIST OF EXPERIMENTS:

1. To generate Amplitude modulated wave and determine its modulation index.
2. To plot the spectrum of Amplitude Modulated wave.
3 To generate Frequency modulated wave and determine its modulation index.
4. To plot spectrum of Frequency Modulated wave.
5. To construct Pulse Amplitude Modulated signal using audio signal generator.
6. To demodulate PAM signal using low pass filter.
7. To verify the operation of Pulse Code Modulation transmitter & receiver circuit.
8. To perform Amplitude Shift Keying & obtain its waveforms.
9. To perform Frequency Shift Keying & obtain its waveforms.
10. To perform Quadrature Phase Shift Keying modulation & demodulation.
11. To perform & study various data formatting techniques.
12. To perform Binary Phase Shift Keying & obtain its output waveforms.
13. To construct Quadrature Amplitude Modulation.
14. To construct Time Division Multiplexing circuit & draw its waveforms.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Design a Square wave generator of frequency 10 MHz
2. Design a Triangular wave generator of frequency 5 KHz.
3. Design a Sine wave generator of variable frequency 1 KHz to 10 KHz.
4. Design a sine wave generator of frequency 1 KHz and variable amplitude upto 10 Vpp.
5. Design a saw tooth wave generator to generate wave of 1 KHz.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-451)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-451.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-451.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-451.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-451.4	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-451.5	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH ANDSTUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-452: ANALOG CIRCUITS LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-402: Analog Circuits
Course Type: Program Core

Course Outcomes
The students will be able to :

BEC-DS-452.1. Demonstrate circuit design by P-Spice.
BEC-DS-452.2. Design and implement Bipolar junction transistor amplifier and Oscillators.
BEC-DS-452.3. Analyze the parameters of operational amplifier along with linear and non linear applications.
BEC-DS-452.4. Implement 555 timer IC and discuss its use as astable and mono stable multivibrator.
BEC-DS-452.5. Demonstrate & design various types of filter circuits.

List of Experiments:

1. To understand the simulation software PSPICE.
2. To design Hartley oscillator using BJT.
3. To design Colpitts oscillator at specified frequency.
4. To measure the op-amp parameters (Open Loop Gain, Input offset voltage CMMR, Slew rate).
5. To analyze the frequency response of Op-amp.
6. To design an inverting amplifier using Op-amp.
7. To design a non inverting amplifier using Op-amp.
8. To design and verify precision rectifier.
9. To verify Op-amp as comparator.
10. To study Op-amp as an integrator.
11. To study Op-amp as a differentiator.
12. To verify Op-amp as Schmitt trigger
13. To verify Astable& Monostable operation using 555 Timer.
14. To design and verify first Order Active High Pass & Low pass filter.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Design a Differential Amplifier.
2. Design a Sine wave Oscillator.
3. Design an Instrumentation Amplifier.
4. Design a VCO.
5. Design a V to I converter.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-452)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3	PSO 4
BEC-DS-452.1	2	3	2	2	2	2	2	2	2	2	2	2	3	2	1	-
BEC-DS-452.2	3	3	2	2	2	2	2	2	3	2	2	2	3	2	1	-
BEC-DS-452.3	3	3	3	2	2	2	2	2	2	2	2	2	3	1	1	-
BEC-DS-452.4	3	3	3	2	2	2	2	2	3	2	2	2	3	2	1	-
BEC-DS-452.5	3	3	3	3	2	2	2	3	2	2	2	2	3	2	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-320: UNIVERSAL HUMAN VALUES

Periods/week	Credits	Max. Marks	: 100
L: 1 T: 1	2	Continuous Evaluation	: 50
Duration of Examination: 2Hrs		End Term Examination	: 50

Pre-requisite: None

Course Type: Humanities & Social Science

Course Outcomes: The course will enable the student to-

BHM-320.1. Develop a holistic perspective based on self-exploration aboutthemselves(humanbeing), family,societyandnature/existence.

BHM-320.2. Understand harmony in the human being,family,society and nature/existence

BHM-320.3. Strengthen the self-reflection, develop commitment and courage to act.

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation(5 Lectures)

Purpose and motivation for the course,Self-Exploration–what is it? - Its content and process; 'Natural Acceptance'andExperiential Validation- astheprocessforself-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Rightunderstanding,RelationshipandPhysicalFacility-thebasic requirements for fulfillment of aspirations of every human being with their correctpriority, Understanding Happiness and Prosperity correctly- A critical appraisal of thecurrentscenario, Method to fulfill the above human aspirations: understanding and living inharmonyatvariouslevels.

Unit2:UnderstandingHarmonyintheHumanBeing-HarmonyinMyself!(5 Lectures)

Understanding human being as a co-existence of the sentient 'I' and thematerial'Body' , Understanding the needs of Self ('I') and 'Body' - happiness and physicalfacility, Understanding the Body as an instrument of 'I' (I being the doer, seer andenjoyer),Understandingthecharacteristicsandactivitiesof 'I'andharmonyin'I', Understanding the harmony of I with the Body: Sanyam and Health; correctappraisalofPhysicalneeds,meaningofProsperityindetail, ProgramstoensureSanyamandHealth.

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship(7 Lectures)

Understanding values in human-human relationship; meaning of Justice (nineuniversal values in relationships) and program for its fulfillment to ensure mutualhappiness;TrustandRespectasthefoundationalvaluesofrelationship, Understanding the meaning of Trust; Difference between intention andcompetence, Understanding the meaning of Respect, Difference between respect anddifferentiation;theother salient values inrelationship

Understanding the harmony in the society (society being an extension offamily): Resolution, Prosperity, fearlessness (trust) and co-existence ascomprehensive Human Goals,Visualizing a universal harmonious order in society- Undivided Society,Universal Order-from familytoworldfamily.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence asCoexistence(6 Lectures)

UnderstandingtheharmonyintheNature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclabilityand self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space Holisticperceptionofharmonyatalllevelsofexistence.

Include practice sessions to discuss human being as cause of imbalance innature (film "Home" can be used), pollution, depletion of resources and role oftechnology etc.

Unit 5: Implications of the above Holistic Understanding of Harmony onProfessionalEthics(5 Lectures)

Naturalacceptanceofhumanvalues, DefinitivenessofEthicalHumanConduct, Basis for Humanistic Education, Humanistic Constitution and HumanisticUniversal Order, Competence in professional ethics, Case studies of typical holistic technologies, management models andproductionsystems, Strategy for transition from the present state to Universal Human Order: a. Atthe level of individual: as socially and ecologically responsible engineers,technologists and managers b. At the level of society: as mutually enrichinginstitutionsand organizations,

Text and ReferenceBooks

1. R R Gaur, R Sangal, G P Bagaria, 2010, Human Values and Professional Ethics,Excel Books, New Delhi
2. A.N. Tripathi, 2019, Human Values, New age International Publishers.
3. E G Seebauer& Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.

Note:

Lecture’s hours are to be used for interactive discussion, placing the proposalsabout the topics at hand and motivating students to reflect, explore and verifythem.

Tutorialhoursaretobeusedforpracticesessions.

Evaluation Tools:

Assessment by faculty mentor: 10 marksSelf-
assessment:10marks

Assessmentbypeers:10marks

Socially relevant project/Group Activities/Assignments: 20 marks

SemesterEndExamination: 50 marks

Course articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
BHM-320.1	-	-	2	-	-	3	1	3	2	-	-	2
BHM-320.2	-	-	2	-	-	3	1	3	2	-	-	2
BHM-320.3	-	-	2	-	-	3	1	3	2	-	-	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-MC-002: SPORTS AND YOGA

Periods/week		Credits	Max. Marks	: 100
L: 2	T: 0	0	Continuous Evaluation	: 100

Duration of Examination: 1Hr

Pre-requisite: None

Course Type: Audit pass

Course Outcomes: The course will enable the student to-

BHM-MC-002.1. Understand the importance of sound health and fitness principles as they relate to better health.

BHM-MC-002.2.Participate in variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.

Unit 1: IntroductiontoPhysicalEducation, Wellness & Lifestyle(6 Lectures)

Meaning&definitionofPhysicalEducation, Aims&ObjectivesofPhysicalEducation,changingtrendsinPhysicalEducation, Meaning&ImportanceofPhysicalFitness&Wellness, ComponentsofPhysical fitness, Healthrelatedfitness and wellness, PreventingHealthThreatsthroughLifestyleChange, ConceptofPositive Lifestyle.

Unit 2: FundamentalsofAnatomy&PhysiologyinPhysicalEducation,Sports&Yoga(8 Lectures)

DefineAnatomy,Physiology&ItsImportance, EffectofexerciseonthefunctioningofVariousBodySystems (CirculatorySystem,RespiratorySystem,Neuro-MuscularSystemetc.), MeaningandConceptofPostures, CausesofBadPosture, Advantages&disadvantagesofweighttraining., Concept&advantagesofCorrectPosture, CommonPosturalDeformities–KnockKnee;FlatFoot;RoundShoulders;Lordosis, Kyphosis,BowLegsandScoliosis, CorrectiveMeasuresforPosturalDeformities.

Unit 3: Yoga&Lifestyle(6 Lectures)

ElementsofYoga, Introduction-Asanas,Pranayama, Meditation&YogicKriyas, Yogaforconcentration&relatedAsanas, RelaxationTechniquesforimprovingconcentration -Yog-nidra, Asanasaspreventivemeasures.

Unit 4: Training, Planning & Psychology in Sports(8 Lectures)

MeaningofTraining, warmingupandlimberingdown, Skill, Technique& Style, MeaningandObjectivesofPlanning, Tournament–Knock-Out,League/RoundRobin&Combination.

Definition&ImportanceofPsychologyinPhysicalEdu.&Sports, Define&DifferentiateBetweenGrowth&Development, AdolescentProblems&TheirManagement, Psychologicalbenefitsofexercise.

TextBooks/References:

1. Ajmer Singh and Rachhpal Singh Brar, 2019, Essentials ofPhysicalEducation, Kalyani Publishers.
2. B.K.S.Iyengar, 2015, Yoga for Sports, Westland publications.

Evaluation Tools:

Class Quiz, Rubrics

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-453: MICROPROCESSORS & MICROCONTROLLERS LAB

Periods/week	Credits	Max. Marks: 100
P:2	1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-403: Microprocessors &Microcontrollers
Course Type: Program Core

Course Outcomes

The students will be able to
BEC-DS-453.1. Describe the importance and function of each pin of 8085, 8086 microprocessor and 8051microcontroller.
BEC-DS-453.2. Apply arithmetic, data transfer and string manipulation instructions to write assembly language program.
BEC-DS-453.3. Analyze branching and loop control instructions.
BEC-DS-453.4. Implement interfacing with switches, keyboard and display devices.
BEC-DS-453.5. Realize concepts of timers and interrupts to generate waveforms

LIST OF EXPERIMENTS:

1. To understand the working of 8085 and 8086 Microprocessor kit.
2. To write and execute a program using 8085 for finding the largest/smallest number from an array and verify the result.
3. To write and execute a program using 8086 for performing the various arithmetic operations and verify the result.
4. To write and execute a program using 8086 to copy 12 bytes of data from source to destination and verify the result.
5. To write and execute a program using 8086 for Hexadecimal to Gray code conversion by using look up table and verify the result.
6. To write and execute a program using 8086 for arranging an array of numbers in ascending order and verify the result.
7. To understand the development tools for 8051 microcontroller programming & Assembly language programming style.
8. To write and execute a program using 8051 for performing the various arithmetic operations and verify the result.
9. To write a program to flash all the LED of o/p part.
10. To write a program to generate 10 KHz square wave using Timers and interrupts.
11. To write a program to display a string on LCD display.
12. To write a program to Interface a Buzzer and Relay with 8051.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. To display a string on LCD Display and verify the result.
2. To reverse a string stored in memory and verify the result
3. To interface L293 Motor Driver IC with 8051 microcontroller.
4. To interface a Real Time Clock (RTC) with 8051 microcontroller.
5. To design an alarm clock using 8051 microcontroller and RTC.
6. To design a line follower Robot using 8051 microcontroller.
7. To control the speed of DC motor using PWM.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-453)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BEC-DS-453.1	1	2	2	2	1	-	-	-	-	-	-	2	2	2	1	-
BEC-DS-453.2	1	2	3	2	2	-	-	-	-	-	-	3	2	2	1	-
BEC-DS-453.3	2	3	3	3	3	-	-	-	-	-	-	3	2	3	2	-
BEC-DS-453.4	1	2	2	2	2	-	-	-	-	-	-	2	2	2	1	-
BEC-DS-453.5	2	3	3	2	3	-	-	-	-	-	-	3	2	3	2	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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DTI- 400: Design, Thinking and Innovation-II

Periods/week	Credits	Max. Marks	: 50
L:0 T:1 P:0	1	Continuous Evaluation	: 50

Pre-requisites: Design, Thinking and Innovation-I
Course Type: Research & Training
Course Coordinator: Mr. Yaman Hooda

Course Outcomes:

DTI 400.1. To understand the research methodologies/approaches/techniques used in the literature
DTI 400.2. To formulate the experimental procedures / algorithms based on research methodology
DTI 400.3. To develop prototype by experiment / simulation.
DTI 400.4. To analyze the recorded data / output.

Activity 1: Methodology Study & Matrix design.

1.1.Analysis of different approach/methodology adopted by various researchers
1.2. Comparative analysis
1.3. Prospective Design.

Activity 2: Design of experiments

2.1 Finalization of experimental procedure / algorithm design.
2.2 Procurement of materials / Hardware and Software.
2.3. Develop experimental setup / design

Activity 3: Execution of experiments/simulations

3.1. Conduct experiments/ build prototype.
3.2. Modification of the experimental set-up / algorithm.

Activity 4:

4.1 Tabulating and analyzing data / output.
4.2 Assessment of the output with earlier published work / product
4.3 Interpretation and presentation of the results / outcome.

Course Articulation Matrix:

CO Statement (XX-400)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
DTI-400.1	3	-	-	2	3	3	-	2	1	-	-	-	1	-
DTI -400.2	3	3	-	3	3	2	1	3	2	-	3	1	3	2
DTI -400.3	3	-	2	2	2	-	3	3	3	3	3	2	3	3
DTI -400.4	3	3	2	1	2	2	2	-	2	2	2	2	3	2

'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

S. No.	Parameters	Description	
1.	**Attendance**	• Percentage of classes attended by the students	**5**
2.	**Continuous Performance**	Group participation and response of the students to a given task: • Judge individual student in the group • Meeting timelines as per lesson plan	**15**
3.	**Experimental Setup / Design**	• Assessment of experimental set up / design • Evaluation of result / outcome. • Validation of results. • Novelty / Relevance of work.	**20**
4.	**Structuring and presentation**	• Structuring and presentation • Group presentation with individual contribution	**10**

References:

1. http://www.sciencedirect.com/
2. https://www.ncbi.nlm.nih.gov/pubmed
3. https://www.elsevier.com/books-and-journals
4. https://www.plos.org/
5. https://www.deepdyve.com/
6. http://ieeexplore.ieee.org/Xplore/home.jsp
7. https://www.researchgate.net/
8. https://www.science.gov/
9. https://scholar.google.co.in/
10. http://www.popsci.com/

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BHM-MC-006: QAPD-I

Periods/week	Credits	Max. Marks :100
L:0 T:0 P :2	AP	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination :50

Pre-requisites:
Course Type:

Course Outcomes:
BHM-MC-006.1. Students will be able to recognize & solve problems based on non-verbal reasoning.
BHM-MC-006.2. Students will be able to solve complex problems based on arithmetic reasoning.
BHM-MC-006.3. Students will be able to apply short tricks on complex problems of verbal reasoning.
BHM-MC-006.4. Students will be able to apply correct usage of grammar in communication.
BHM-MC-006.5. Students will be able to enhance their vocabulary and use it in day to day life.
BHM-MC-006.6. Students will be able to develop speed reading & writing skills.

PART – A

Unit 1: Arithmetic II
1.1 Percentages
1.2 Ratio & Proportion
- 1.2.1. Proportionality
- 1.2.2. Variations
- 1.2.3 Partnership

1.3 Profit & Loss
- 1.3.1. Basic terminology & Formulae
- 1.3.2. Error in Weights
- 1.3.3. Marked Price and Discounts

1.4Time & Work
- 1.4.1. Time and Work, Chain Rule
- 1.4.1. Work & Wages
- 1.4.2. Pipes & Cisterns

1.5 Mixtures &Alligations

Unit 2: Verbal Reasoning 2

- 2.1 Syllogism
- 2.2 Ranking
- 2.3 Coding-Decoding
- 2.4Inequalities and Mathematical Operations

Unit 3: Non Verbal Reasoning
- 3.1 Pictorial Series
- 3.2 Missing Values
- 3.3 Analogy and Images

Part B

Unit 4: Communication Accuracy

4.1 Relevance of Verbal Ability and preparatory guidelines
4.2 Functional Grammar – Subject Verb Agreement
4.3 Tenses – Perfect, Simple, Continuous
4.4 Common Errors and rectification

Unit 5: Word Power Building Skills

5.1 Words: Antonyms, Synonyms, Verbal Analogies
5.2 Compound words: Homophones, Homonyms, Word Families
5.3 Root Word Technique for Prefixes & Suffixes
5.4: Word Power: 7 Tips for Learning New Words
5.5 Practice Vocabulary Exercises

Unit 6: Reading & Writing Skills

6.1 Objectives of Reading, Definition & Types of Reading & Importance of Reading
6.2 Reading Techniques: SW3R, Active Reading, Detailed, Speed
6.3 Practice Exercises: Short & Medium Passages3.1 Writing: Introduction of Writing Skills, Objectives of enhancing Writing Skills & Types of Writing
6.4 Sentences, Phrases, Types of Sentences, Parts of Sentences
6.5 Paragraph Writing: Construction, Linkage & Cohesion

Text Books/Reference Books:

1. R S Aggarwal , 2017, Quantitative Aptitude for Competitive Examinations, S Chand & Company PvtLtd.
2. R S Aggarwal, 2018,A Modern Approach to Verbal& Non Verbal Reasoning:, S Chand & Company Pvt Ltd.
3. Verbal Ability and Reading Comprehension, MVN Enterprises
4. P.A. Anand ,Verbal Ability and Reasoning for Competitive Examinations, Wiley

Instructions for paper setting: Fifty MCQ will be set in total. Twenty five MCQ will be set from Part A and twenty five MCQ will be set from Part B. All questions will be compulsory. Each question will be of 1 mark. There will be no negative marking. Calculator will not be allowed.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
BHM-MC-006.1	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2
BHM-MC-006.2	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
BHM-MC-006.3	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2
BHM-MC-006.4	1	-	-	1	-	-	-	-	1	3	-	2	1	2	-	1
BHM-MC-006.5	1	-	-	1	-	1	-	-	1	3	-	2	1	2	-	1
BHM-MC-006.6	1	2	-	1	1	1	1	1	1	3	1	2	1	2	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-304 PYTHON PROGRAMMING AND RASPBERRY PI FUNDAMENTALS

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Program Core

Course Outcomes:
The students will be able to:

BEC-DS-304.1: Understand various core programming basics—including data types, control structures, algorithm development,

BEC-DS-304.2: Discuss the applications of Python and understand program design with functions—via the Python programming language.

BEC-DS-304.3: Solve problems, explore real-world software development challenges, and create practical and contemporary applications

BEC-DS-304.4Understand the advantages of Intel Distribution for Python over traditional Python distributions and develop an understanding of functionality and implementation methodology of Raspberry Pi

BEC-DS-304.5: Able to integrate Intel Neural Compute Stick with Raspberry Pi to create systems and understand the concept of Edge Computing and the working of Intel OpenVINO toolkit

PART-A

Unit1: Introduction to Python Programming Language

1.1 Introduction to python programming language, Interpreted Language
1.2 Installing Python; basic syntax, interactive shell
1.3 Editing, saving, and running a script. Basic variables
1.4 Keywords, operators and operands, Data types in python
1.5 Operators, Conditional Statements, Loops in Python

Unit 2: Advanced Programming Concepts

2.1Strings: accessing and basic operations, lists: accessing and operations

2.2Tuple: Accessing and operations

2.3 Functions: Defining and calling and its types
2.4 Modules: importing and using a module
2.5 Simple graphics and Image processing

Unit 3: Object Oriented Programming

3.1Classes and OOP: classes, objects, attributes and methods
3.2Defining classes; design with classes
3.3Data modeling; persistent storage of objects
3.4Inheritance, polymorphism, operator overloading (_eq_, _str_, etc)
3.5Abstract classes; exception handling, try block
3.6 What is Intel Distribution for Python, How Does Intel Boost Python's Performance
3.7Packages included in Intel Distribution for Python, Applications of Intel Distribution for Python
3.8How to use Intel Distribution for Python

PART-B

Unit 4: GUI Programming

4.1 Graphical user interfaces
4.2 Event-driven programming paradigm
4.3 Tkinter module, creating simple GUI
4.4 Buttons, labels, entry fields, dialogs
4.5 Widget attributes - sizes, fonts, colors layouts, nested frames

Unit 5: Introduction to Raspberry Pi

5.1Introduction to Raspberry Pi Board its features and different versions
5.2Configuring the Raspberry Pi board
5.3Basic Understanding of the Linux Based Operating System
5.4 Shell commands, working on Linux Terminal
5.5 Vi and Nano editor, configuring remote SSH, shell script.

Unit 6: Programming Raspberry Pi board & Communication protocols

6.1 Programming GPIO using Python,
6.2 LED blinking, reading input from push button,
6.3 UART, SPI, I2C, DHT11 sensor interfacing,
6.4 Raspberry Pi as MQTT broker, sending sensor data to cloud,
6.5 Python GUI for LED control using Raspberry Pi,
6.6 Introduction to Intel Neural Compute Stick 2 (NCS2), NCS2 interfacing with Raspberry Pi.
6.7 Introduction to Intel OpenVINOToolKit and Edge Computing

Text Books/ Reference Books:

1. Kenneth Lambert , 2012, Fundamentals of Python: First Programs, Course Technology, Cengage Learning, ISBN-13: 978-1-111-82270-5
2. John V. Guttag., 2016. Introduction to computation and programming using python: with applications to understanding data. PHI Publisher.
3. Charles Severance, Python for Everybody: Exploring Data in Python 3, Elliott Hauser (Editor), Sue Blumenberg (Editor), ASIN: B01IA5VIFM.
4. Simon Monk, 2013, Programming the Raspberry Pi: Getting Started with Python, McGraw-Hill Education TAB, ISBN-13: 978-0071807838
5. Simon Monk, 2016, 2nd Edition Raspberry Pi Cookbook: Software and Hardware Problems and Solutions, O'Reilly Media; ISBN-13: 978-1491939109.
6. Tim Cox , Dr. Steven Lawrence Fernandes, 2018, 3rd Edition, Raspberry Pi 3 Cookbook for Python Programmers: Unleash the potential of Raspberry Pi 3 with over 100 recipes, Packt Publishing; ISBN-13: 978-1788629874.

Software required/Weblinks:
Turbo C
www.tutorialpoint.com
www.nptel.com
www.w3schools.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BCS-DS-304)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
BCS-DS-304.1	3	3	2	3	3	3	1	1	2	2	2	2				
BCS-DS-304.2	3	3	3	3	2	3	1	2	2	2	1	2				
BCS-DS-304.3	3	2	3	3	3	3	1	1	2	2	1	2				
BCS-DS-304.4	3	3	3	3	3	3	1	1	2	3	1	2			2	
BCS-DS-304.5	3	2	3	2	3	2	2	1	2	3	1	2			2	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-354 PYTHON PROGRAMMING AND RASPBERRY PI FUNDAMENTALS LAB

Periods/week Credits	Max. Marks : 100
P: 2 1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs	End Semester Examination : 50

Co-Requisite: Python Programming and Raspberry PI Fundamentals (BEC-DS-305)
Course Type: Core

Course Outcomes:
The students will be able to:

BEC-DS-354.1: Understand various core programming basics—including data types, control structures, algorithm development,
BEC-DS-354.2: Overview the applications of Python and understand program design with functions—via the Python programming language.
BEC-DS-354.3: Develop an understanding of functionality and implementation methodology of Raspberry Pi
BEC-DS-354.4: Able to integrate Intel Neural Compute Stick with Raspberry Pi and understand the working of Intel OpenVINO toolkit

List of Practicals:

1. Write a program to find all prime numbers within a given range of numbers.
2. Write a program to print n terms of Fibonacci series.
3. Write a program to demonstrate the use of list and related functions.
4. Write a python program to demonstrate the use of tuple, set and related functions.
5. Write a python program to read and write from a file.
6. Write a program to demonstrate inheritance.
7. Write a python program to perform data insertion and deletion into a table using Python GUI.
8. Write a python program to perform linear search.
9. Familiarization with Raspberry Pi environment and installation of necessary software.
10. To interface LED/Buzzer with Raspberry Pi and to write a program to turn LED/Buzzer ON for 1 sec after every 2 sec.
11. To interface Push button/Digital sensor (IR/LDR) with Raspberry Pi and write a program to turn ON the LED when push button is pressed or at sensor detection.
12. To interface DHT11 sensor with Raspberry Pi and send the temperate and humidity data on Thingspeak cloud.
13. To install MySQL data base on Raspberry Pi and perform basic SQL queries.
14. Write a program on Raspberry Pi to publish/subscribe temperature data to/from MQTT broker.
15. Write a program to create TCP server on Raspberry Pi and respond with humidity data to client when requested.
16. To interface Raspberry Pi with Arduino.
17. Implementation of data communication between smartphone and Raspberry Pi over Bluetooth

18. Interfacing of Raspberry Pi camera module with Raspberry Pi for capturing images.
19. Interfacing Intel NCS2 with Raspberry Pi and running demo scripts.
20.Optimizing public and intel deep Learning models using Intel OpenVINO toolkit
21.Installing and setting up Intel Distribution for Python
22.Integrating Intel Distribution for Python with Anaconda
23.Comparing Intel Distribution for Python with traditional Python distributions

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Interfacing of Intel NCS2 with Raspberry Pi for image classification application.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-354)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-354.1	3	1	2	1	1	-	-	-	-	-	-	2	3	3	1	3
BEC-DS-354.2	3	2	3	3	2	-	-	-	-	-	-	2	3	3	2	3
BEC-DS-354.3	3	2	3	3	2	-	-	-	-	-	-	2	3	3	2	3
BEC-DS-354.4	3	1	3	2	2	-	-	-	-	-	-	2	3	3	2	2

SEMESTER 5

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-503A: ANTENNAS

Periods/week Credits	Max. Marks: 200
L: 3 T: 0 3	Continuous Evaluation: 100
Duration of Examination: 3Hrs	End Semester Examination: 100

Course Type: Core

Prerequisites: Basic knowledge of Electromagnetic Waves.

Industry Support: Telecom industry, defense industry and space organization.

Course Outcomes

The students will be able to:

BEC-DS-503.1. Define Basic antenna parameters like radiation pattern, directivity and gain.
BEC-DS-503.2. Derive the field equations for the basic radiating elements like linear wire antenna and loop antenna.
BEC-DS-503.3. Analyze of uniform linear and planar antenna arrays using isotropic and directional Sources.
BEC-DS-503.4. Implement special types of Antennas like wire, planar antennas and reflectors.
BEC-DS-503.5. understands modes of radio wave propagation and various techniques of measurement of antenna parameters.

PART-A

Unit 1:Introduction

1.1 Introduction, Type of Antennas, Radiation Mechanism, Historical Advancement
1.2 Hertzian dipole-its radiation resistance and power radiated
1.3 Short dipole- its radiation resistance and power radiated

Unit 2: Antenna Characteristics

2.1 Radiation pattern, Principle plane patterns
2.2 Radiation intensity, Radiation power density, Beam solid angle, Directivity, Directive gain, power gain
2.3 Bandwidth, Antenna efficiency, Antenna beam width, Effective aperture
2.4 Reciprocity theorem for antenna, Polarization
2.5 Noise figure and noise temperature

Unit 3: Antenna Arrays

3.1 Introduction, Broadside array, End-fire array
3.2 Array of two point sources, Multiplication of patterns
3.3 Linear arrays of N isotropic sources, Binomial arrays

PART-B

Unit 4: Practical Antennas

4.1 Monopole, Half wave dipole, Small Loop antenna
4.2 Folded dipole antenna, Yagi-Uda antenna, Log-periodic Antenna
4.3 Biconical antenna, Helical antenna, Horn antenna
4.4 Parabolic reflector antenna, Planar antenna

Unit 5: Radio Wave Propagation

5.1 Modes of wave propagation, Ground or surface wave propagation, Space wave propagation: Range of space wave
5.2 Concept of effective earth's radius
5.3 Tropospheric scatter propagation, duct propagation
5.4 Ionospheric wave propagation, structure of ionosphere
5.5 Sky wave propagation, Mechanism of bending in ionosphere
5.6 Earth's effect on ionosphere, Critical frequency, refractive index, Virtual height, MUF, LUF, OWF, Skip distance

Unit 6: Antenna Measurements

6.1 Antenna Measurement Range
6.2 Radiation pattern measurement
6.3 Gain and Directivity measurement, Input Impedance Measurement
6.4 Measurement of antenna efficiency
6.5 Noise figure, Noise temperature measurement

Text Books/ Reference Books:

1. A.R. Harish, M. Sachidananda, 2007, Antennas and Wave Propagation, 4th Edition, Illustrated Publisher Oxford University Press.
2. C.A.Balanis, 2009, Antenna Theory: Analysis & Design, 2nd Edition, Wiley India.
3. Robert E. Collin, 2007, Antenna & Radio Wave Propagation, 4th Edition, McGraw-Hill Higher Education.
4. GSN Raju, 2006, Antenna and Wave propagation, 3rd Edition, Pearson Education.
5. Antennas and Wave Propagation by J D Kraus, McGraw-Hill Higher Education

Software required/Weblinks:

MATLAB
http://nptel.ac.in/courses/117102060/
http://nptel.ac.in/courses/117107035/1- 117107035/42

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-503)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-503.1	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2	-
BEC-DS-503.2	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2	-
BEC-DS-503.3	3	3	2	2	2	-	-	-	-	-	-	-	3	1	1	-
BEC-DS-503.4	3	3	2	2	2	-	-	-	-	-	-	-	3	2	2	
BEC-DS-503.5	3	3	2	2	3	-	-	-	2	-	-	-	3	1	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-501A: DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS

Periods/week	Credits	Max. Marks	: 200
L: 3 T:0	3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Course Type: Program Core

Course Outcomes

The students will be able to:

BEC-DS-504.1. Explain various application areas of digital signal processing and its advantages.
BEC-DS-504.2.Analyse discrete-time systems using z-transform.
BEC-DS-504.3.Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
BEC-DS-504.4. Design digital filters for various applications.
BEC-DS-504.5. Apply digital signal processing for the analysis of real-life signals.

PART-A

Unit 1: Introduction to Digital Signal Processing

1.1 Introduction to Analog Signal Processing & Digital Signal Processing, Sampling and reconstruction of signals, representation of signals on orthogonal basis, Parametric and non-parametric spectral estimation.
1.2 Advantages of Digital Signal Processing (DSP)
1.3 Review of manipulations on Discrete Signals

Unit 2: Z-Transform

2.1 Definition of Z-transform
2.2 ROC & its Properties
2.3 Relation between s-plane & z-plane
2.4 Properties of Z-transform & its proof: Linearity, Time Shifting, Time Scaling, Time Reversal, Differentiation in frequency domain, Convolution in time domain, Correlation in time domain
2.5 Numericals on Z-transform
2.6 Inverse Z-transform using Long Division Method & Partial Fraction Method
2.7 Analysis of LTI systems using Z-transform

Unit 3: Discrete Fourier Transform (DFT)

3.1 Definition of DFT and its numericals
3.2 Relationship of DFT to other transforms
3.3 Properties of DFT: Periodicity, linearity and symmetry
3.4 Inverse DFT and its numericals
3.5 Efficient computation of DFT (FFT): Phase Factor & its Properties
3.6 Radix-2 FFT algorithms: Decimation in Time (DIT) & Decimation in Frequency (DIF)
3.7 Numericals on FFT

3.8 Circular Convolution & its relation with linear convolution

PART-B

Unit 4: Finite Impulse response (FIR) Filter

4.1 Magnitude and phase response of FIR filters
4.2 Linear Phase FIR Filter
4.3 Basic structures for FIR systems: Direct Form Realization, Linear phase FIR structure
4.4 Design technique for FIR filters (Derivations &Numericals): Fourier Series method, Window techniques (Rectangular, Hamming, Hanning and Blackmann window functions), Park-McClellan's method

Unit 5: Infinite Impulse Response (IIR) Filter

5.1 Design of IIR Digital Filters (Derivation &Numericals): Approximation of derivatives Method, Impulse invariant Method, Bilinear transformation method
5.2 Characteristics & Comparison of Analog filters: Butterworth filter, Chebyshev Filter, Inverse Chebyshev Filter and Elliptic Filter
5.3 Basic structures for IIR systems: Direct forms (I & II), Cascade realization and Parallel realisation, Ladder Structure

Unit 6: Applications of DSP

6.1 Applications of DSP: Biomedical Engineering, Voice Processing, Image Processing, RADAR
6.2 Introduction to DSP Processor
6.3 Introduction to Multirate DSP
6.4 Introduction to Finite Word Length Effect

Text Books/Reference Books:

1. John G.Proakis and Dimitris G.Manolakis, 2006, Digital Signal Processing, Principles, Algorithms and Applications , 4th Edition, Prentice Hall.
2. Salivahanan, Vallavaraj and Gananapriya, 2001, Digital Signal Processing, 2nd Edition, TMH.
3. Oppenheim A.V. & Schafer, Ronald W, 1998, Discrete Time Signal Processing, 2nd Edition, Prentice Hall.
4. Sanjit K. Mitra , 2005, Digital Signal Processing, 3rd Edition, Mc Graw Hill.

Software required/Weblinks:

MATLAB
http://nptel.ac.in/courses/117102060/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-504)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-504.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-504.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-504.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-504.4	3	3	3	1	3	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-504.5	3	3	3	1	2	-	-	-	-	-	-	2	3	1	2	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-508: PROBABILITY AND STOCHASTIC PROCESSES

Periods/week	Credits	Max. Marks : 200
P: 2	1	Continuous Evaluation : 100
Duration of Examination: 2 Hrs		End Semester Examination : 100

Co-requisites:
Course Type: Program Core

Course Outcomes
The students will be able to:

BEC-DS-508.1:. Understand representation of random signals
BEC-DS-508.2. Investigate characteristics of random processes
BEC-DS-508.3. Make use of theorems related to random signals
BEC-DS-508.4. Analyze propagation of random signals in LTI systems.

PART-A

UNIT I: PROBABILITY

1.1Sets and set operations;
1.2 Probability space;
1.3Conditional probability and Bayes theorem;
1.4 Combinatorial probability and sampling models.

UNIT II: THE RANDOM VARIABLE

2.1 Random Variables: Discrete random variables,
2.2 Probability mass function, probability distribution function,
2.3 Example random variables and distributions;
2.4 Continuous random variables, probability density function, probability distribution function
2.5 Example distributions: Binomial, Poisson, Uniform, Exponential, Gaussian, Rayleigh

UNIT III: Operations on One Random Variable

3.1 Expectations
3.2 Moments of random variables;
3.3 Conditional distribution, densities and moments;
3.4 Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;
3.5 Transformations of a Random Variable

PART-B

UNIT IV: Multiple Random Variables

4.1 Joint Distributions and its properties
4.2 Joint density and its properties
4.3 Conditional distribution and density

4.4 Statistical Independence
4.5 Distribution and density of a sum of Random variables
4.6 Central Limit Theorem.

UNIT V: Random Processes

5.1 Random process
5.2. Stationary processes.
5.3 Mean and covariance functions. Correlation
5.4 Ergodicity.
5.5 Transmission of random process through LTI.
5.6 Power spectral density

UNIT VI: Optimal Linear Systems

6.1Introduction
6.2 Systems that maximize Signal-to-Noise Ratio: Matched filter for white noise
6.3 Systems that minimize mean-squared error: Wiener filter

Text/Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes,'' Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-508**)**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-508.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-508.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-508.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-508.4	3	3	3	1	3	-	-	-	-	-	-	2	3	1	2	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-551A: DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites:BEC-DS-504A: Digital Signal Processing and its Applications
Course Type: Program Core

Course Outcomes

The students will be able to:

BEC-DS-551.1. Appreciate working on MATLAB tool and differentiate between different workspace of MATLAB.
BEC-DS-551.2. Demonstrate the effect of under sampling and necessity of sampling theorem.
BEC-DS-551.3. Design digital filters which include IIR filter and FIR filter.
BEC-DS-551.4. Apply code composer studio (CCS) to interface DSK6713 kit .
BEC-DS-551.5. Generate simple waveforms using DSK6713 kit.

LIST OF EXPERIMENTS:

1. To represent basic continuous & discrete time signals (Ramp, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sine, Sinc).
2. To perform basic operations on sequences like addition , multiplication, scaling, shifting, folding and also compute energy and power.
3. To calculate Inverse Z-transform of a rational transfer function and to check stability of a system.
4. To compute DFT of a given discrete time sequence.
5. To find step response and unit impulse response of a system from its difference equation.
6. To perform linear & circular convolution of two discrete time signals.
7. To prove sampling Theorem.
8. To convert Analog filter into Digital filter using Impulse Invariant & Bilinear Transformation method.
9. To design Digital filter using Rectangular window.
10. To study effect of Random Noise on a Signal and to minimize its Effect using FIR filter
11. To generate Sine wave using DSK6713 trainer kit.
12. To perform convolution using DSK6713 trainer kit.
13. To generate echo of a signal using DSK 6713 kit.
14. To perform DFT of a sequence using DSK 6713 kit.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. To design a multirate system using MATLAB/SIMULINK.
2. To design a noise cancellation system using adaptive filters to reduce noise in MATLAB/SIMULINK.
3. IIR Filter design and analysis using FDA Tool.
4. To compare Amplitude modulation techniques using MATLAB/SIMULINK.
5. FIR Filter design and Spectrum analysis using MATLAB/SIMULINK.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-551**)**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-551.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-551.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-551.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-551.4	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-551.5	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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PROJ-EC-500: SUMMER INTERNSHIP-II

Duration of Training: 4 weeks | Max. Marks : 100
Credits: 2 | Continuous Evaluation: 100

Pre-requisites: Solid foundation of Core Subjects
Course Type: Internships/Seminars

Course Outcomes
The students will be able to:

Proj-EC-500.1. Analyze the real working environment and get acquainted with the organizational structure, business operations and administrative functions.
Proj-EC-500.2. Apply subject knowledge to related fields so that they can relate and reinforce what has been taught at the university.
Proj-EC-500.3. Develop synergetic collaboration between industry and the university.
Proj-EC-500.4. Demonstrate the role of the professional/specialist/manager/supervisor confidently in the relevant industry.
Proj-EC-500.5. Explore options in their career plans and make a gradual transition from academia to career.

Every student will have to undergo Industrial Training for 4 weeks in the relevant field of Engineering in which he/she is enrolled for B.Tech programme after 4th semester. Respective Head of Department will approve the Industry/Organization for training. During this course of time he/she will be regularly monitored and evaluated. Before he/she is again registered for next semester i.e. 5th semester of studies, the student will have to submit the training report, deliver a seminar about the work/project undertaken during the training and will have to appear for viva. The evaluation of the industrial training shall be made as following:

Assessment Tools:
Continuous Evaluation during training:

1. Evaluation by the Supervisor in the Industry	:	30 marks
2. Evaluation by Faculty mentor during training visit	:	30 marks
3. Internal Seminar/Presentation	:	40 marks
Total Internal Marks	:	**100**
Total Credits	:	**2**

The parameters for evaluation during the training for Supervisor shall be as under:

		Marks
a)	Work/Project undertaken	5
b)	Punctuality/ Regularity	5
c)	Discipline/ Overall Conduct/ Relations with Seniors and others	5
d)	Eagerness to acquire Technical Knowledge	5
e)	Overall Proficiency achieved during Training	5

f) Any contribution to the organization 5

Total 30

The parameters for evaluation by the faculty during training shall be as under:

a) Maintenance of Training Diary and Regularity 5
b) Relations with Seniors and others 5
c) Overall Conduct 10
d) Willingness to Work 5
e) Proficiency achieved 5

30

Course Articulation Matrix

CO Statement (Proj-EC-500)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
Proj-EC-500.1	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
Proj-EC-500.2	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
Proj-EC-500.3	3	3	2	3	3	2	2	3	3	3	3	2	3	3	3	3
Proj-EC-500.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
Proj-EC-500.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-520: Entrepreneurship and Startups

Periods/week Credits	Max. Marks	: 200
L: 2 T: 0 2	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Term Examination	: 100

Pre-requisite:
Course Type: Humanities & Social Science

Course Outcomes: The course will enable the student to-

BHM-520.1. Acquire Entrepreneurialspiritandresourcefulness.
BHM-520.2. Understand theconceptandprocessofentrepreneurship-itscontributionandrole in thegrowthanddevelopmentofindividualsandthenation.

BHM-520.3. Strengthen the skillsofcreationandmanagementofentrepreneurialventure.

Unit1:Introduction to Entrepreneurship and Start–Ups(6 Lectures)

Definition and Traitsofanentrepreneur,Intrapreneurship,Motivation, typesofBusinessStructures,Similarities/differencesbetweenentrepreneursandmanagers.

Unit2:Business Ideas and their implementation(6 Lectures)

Discoveringideasandvisualizingthebusiness, Activitymap, BusinessPlan

Unit3:Idea to Start-up and Management(7 Lectures)

MarketAnalysis–Identifyingthetargetmarket, CompetitionevaluationandStrategydevelopment, Marketingandaccounting, Riskanalysis, Company'sOrganizationStructure, Recruitmentandmanagementoftalent, financialorganizationandmanagement

Unit4:Financing, Protection ofIdeas and Exit strategies(7 Lectures)

Financingmethodsavailableforstart-upsinIndia, CommunicationofIdeastopotentialinvestors–InvestorPitch, PatentingandLicenses

Text Books/ Reference books/Web references:

1. SteveBlankandBobDorf, 2020, TheStartupOwner’sManual:TheStep-by-StepGuideforBuildingaGreatCompany,wiley.
2. Eric Ries, 2011, The Lean Startup: How Today’s Entrepreneurs use ContinuousInnovationtoCreateRadicallySuccessfulBusinesses by EricRies, Penguin UK.

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

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

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

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

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Quiz	20%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Assignments, Sessional and End Semester Examination paper will consist of various difficulty levels to accommodate the different capabilities of students. Assessment should cover all course outcomes and upper limit for lower order skills will be 40% (for knowledge-oriented questions). However, weightage for different cognitive levels in the question papers can vary.

Instructions for paper setting: The paper setter must ensure the coverage of entire syllabus while setting the question papers and mention the learning outcomes across each section to be measured by the examination. Weightage of the sections may vary as per the number of respective lecture hours mentioned in the syllabus.Action verbs should be used from Bloom's Taxonomy while designing question papers.

Course articulation Matrix

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
BHM520.1	-	-	-	-	-	-	-	1	2	2	2	2
BHM-520.2	-	-	-	-	-	-	-	1	2	3	2	2
BHM-520.3	-	-	-	-	-	-	-	1	2	3	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956**)**

DTI -500: Design, Thinking and Innovation-III

Periods/week	Credits	Max. Marks : 50
L:0 T:2 P:0	2	Continuous Evaluation : 50

Pre-requisites: Design, Thinking and Innovation-II
Course Type: Research & Training
Course Coordinator: Mr. Yaman Hooda

Course outcomes
The students will be able to**:**

DTI – 500.1 Understand the Plagiarism / Feasibility tools
DTI – 500.2 Document the outcome as Research Paper / Patent / Product / Start-up /copyright

Activity 1:

1.1 Compilation / Documentation of the outcome (Research Paper / Patent / Product / Start-up /copyright).
1.2 Plagiarism / Feasibility check.
1.3 Identification of the suitable Journal / Patenting Agencies / Angel Investors.
1.4 Submission to the identified Journal / Patenting Agencies / Angel Investors.

Course Articulation Matrix:

CO Statement (DTI-500)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
DTI-500.1	-	3	-	-	-	-	-	3	-	-	-	1	-	-
DTI -500.2	-	3	2	3	2	2	2	3	3	3	2	2	3	3

'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

S. No.	Parameters	Description	(Marks)
1.	**Attendance**	• Percentage of classes attended by the students	**5**
2.	**Continuous Performance**	• Judge individual student's participation in the Activities • Time bound completion of Activities	**15**

3.	**Accomplishment of the Outcome**	• Quality of the content and results • Acceptance of the outcome (Research Paper/ Patent/ Product/ Copyright) • Report submission / Presentation	**30**

References:

1. www.originlab.com
2. http://www.cambridgesoft.com/software
3. http://www.synergy.com/
4. www.mathworks.com/products/matlab.html

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BHM-MC-008: QAPD-II

Periods/week	Credits	Max. Marks: 100
L:0 T:0 P :2	AP	Continuous Evaluation: 50
Duration of Examination: 2 Hrs		End Semester Examination :50

Course Type: Elective

Course Outcomes:
BHM-MC-008.1. Students will be able to analyze various forms of data.
BHM-MC-008.2. Students will be able to solve complex problems based on arithmetic reasoning.
BHM-MC-008.3. Students will be able to apply short tricks on complex problems of number system.
BHM-MC-008.4. Students will be able to enhance and expand word knowledge by fostering word consciousness.
BHM-MC-008.5. Students will be able to construct simple and complex sentences accurately.
BHM-MC-008.6. Students will be able to develop reading skills & build verbal reasoning skills.

PART – A

Unit 1: Number System II
1.4 Factors and Multiples
1.5 Unit Digits & Cyclicity
1.6 Remainders
1.7 Factorials
1.8 Logarithm

Unit 2: Arithmetic III
2.1 Interest
- 2.1.1 Simple Interest
- 2.1.2 Compound Interest
- 2.1.3 Relation between SI & CI

2.2 Time, Speed & Distance
- 2.2.1 Basics Formulas & Proportionality
- 2.2.2 Average & Relative Speed
- 2.2.3 Trains and Boats & Streams
- 2.2.4 Circular Motion and Clocks

2.3Data Interpretation
- 2.3.1 Table and Bar graph
- 2.3.2 Line and Pie Charts
- 2.3.1 Mixed Charts and Caselets

Unit 3: Verbal Reasoning III
- 3.1 Calendar
- 3.2 Cubes and Dices
- 3.3 Data Sufficiency

PART – B

Unit 4: Advanced Vocabulary

4.1 Synonym & Antonym
4.2 One Word Substitution
4.3 Ordering of Words
4.4 Idioms and Phrases
4.5 Vocabulary, COW, Punctuation

Unit 5: Sentence Construction & Syntax

5.1 Sentence Improvement
5.2 Spotting Errors
5.3 Ordering of Sentences
5.4 Change of Voice/ Direct & Indirect speech
5.5 Completing Statements/Sentences

Unit 6: Reading Comprehension & Reasoning

6.1 Strategic Reading, Eliminating Poor Reading Habits
6.2 Techniques to increase speed reading, comprehension and recall
6.3 Solving Sample RC Passages
6.4 Closet Test
6.5 Para Jumbles

Text Books/Reference Books:

1.R S Aggarwal, 2017, Quantitative Aptitude for Competitive Examinations, S Chand & Company Pvt Ltd.
2.R S Aggarwal, 2018, A Modern Approach to Verbal &Non Verbal Reasoning, S Chand & Company Pvt Ltd.
3.R S Aggarwal, An Advanced Approach to Data interpretation, S Chand & Company Pvt Ltd.
4.P.A. Anand, Verbal Ability and Reasoning for Competitive Examinations, Wiley.

Instructions for paper setting: Fifty MCQ will be set in total. Twenty five MCQ will be set from Part A and twenty five MCQ will be set from Part B. All questions will be compulsory. Each question will be of 1 mark. There will be no negative marking. Calculator will not be allowed.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (BHM-MC-008)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PS 2	PS 3	PS 4
BHM-MC-008.1	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2
BHM-MC-008.2	1	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2
BHM-MC-008.3	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
BHM-MC-008.4	1	-	1	-	-	-	-	-	1	3	1	2	1	1	1	1
BHM-MC-008.5	1	-	1	1	-	1	-	-	1	3	1	2	-	-	1	1
BHM-MC-008.6	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-406 ARTIFICIAL INTELLIGENCE

Periods/week	Credits	Max. Marks : 200
L :3 T: 0 P:0	3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Course Type: Program Core

Course Outcomes
The student will be able to:

BEC-DS-406.1: Understand AI concepts and applications
BEC-DS-406.2: Apprehend intelligent agents and their types
BEC-DS-406.3: Generate reasoning from given available information
BEC-DS-406.4: Differentiate between supervised and unsupervised learning process
BEC-DS-406.5: Understand representation of knowledge and its usage and apply AI knowledge for solving real life problems

PART- A

Unit 1: Introduction to Artificial Intelligence

1.1 Introduction to AI, History of AI
1.2 Turing test approach
1.3 Multidisciplinary foundation of AI
1.4 Intelligent Agents and Task environments
1.5 Learning Agents
1.6 Rationality and Omniscience
1.7 Application Areas for AI- Robotics, Gaming, Machine Learning, Biometrics, Cognitive Science, Medicine, Expert Systems, etc.
1.8 AI present and future

Unit 2: Problem Solving through AI

2.1 Problem Solving Agents
2.2 Measuring problem-solving performance
2.3 Uninformed search strategies- BFS, DFS, DLS, ID-DFS
2.4 Searching with partial information- Sensorless and Contingency approach
2.5 Heuristic search strategies- Greedy best-first, A*, AO*,
2.6 Local Search and optimization- Gradient ascent, Hill Climbing, Simulated annealing, genetic algorithms
2.7 Constraint satisfaction problem- backtracking search
2.8 Adversarial search- Game playing, Min-Max, alpha-beta pruning

Unit 3: Knowledge and Reasoning

3.1 Knowledge based agents
3.2 Proposition and first order logic
3.3 Forward and backward chaining
3.4 Expert systems, example of MYCIN
3.5 Inference in first order logic, Inference Resolution
3.6 Representation of knowledge and KDD
3.7 Dealing with Uncertainty- Bayes' Rule
3.8 Probabilistic reasoning over time
3.9 Markov process and Markov model (HMM)

PART- B

Unit 4: Machine Learning

4.1 Learning from observations
4.2 Learning decision tree
4.3 Statistical form of learning
4.4 Supervised learning
4.5 Maximum likelihood approach
4.6 Naïve Bayes' model
4.7 Expectation maximization algorithm against missing, noisy or hidden values
4.8 Unsupervised learning- learning by exploration

Unit 5: Advanced Machine Learning

5.1 Introduction to Classification- Regression
5.2 Introduction to Classification- K Nearest Neighbour
5.3 Introduction to Clustering- K-Means clustering
5.4 Reinforcement Learning
5.5 Biological neuron to Artificial neurons
5.6 Perceptron model
5.7 Introduction to neural networks
5.8 Multi-layer perceptron
5.9 Introduction to deep learning

Unit 6: Understanding Real World Applications of AI

6.1 Natural language Processing
6.2 Computer Vision
6.3 Robotics
6.4 Self-Driven Vehicles
6.5 Expert Systems
6.6 AI Chatbot
6.7 Home Automation Systems

Text Books/ Reference Books:

1. Stuart Rusell, Peter Norvig, 2nd Edition, Artificial Intelligence: A Modern Approach.
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis

Software required/Weblinks:

http://nptel.ac.in/courses/117103065/1- 117103065/55

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-406)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-406.1	3	3	3	2	1	-	2	-	-	-	-	-	2	2	1	-
BEC-DS-406.2	2	3	2	2	1	-	-	-	-	-	-	1	2	2	1	-
BEC-DS-406.3	3	3	3	3	-	-	-	-	-	-	-	-	-	2	1	-
BEC-DS-406.4	1	-	2	-	-	-	-	-	-	-	-	2	-	-	-	-
BEC-DS-406.5	-	-	3	-	1	-	1	-	-	-	-	2	-	-	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-456: ARTIFICIAL INTELLIGENCE LAB

Periods/week	Credits	Max. Marks: 100
P:2	1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-406: Artificial Intelligence
Course Type: Program Core

Course Outcomes

The students will be able to

BEC-DS-456.1: Analyze search methods and identify best solution in AI domain
BEC-DS-456.2: Learn to create probabilistic models and generate inferences from existing information
BEC-DS-456.3: Create neural networks in programming
BEC-DS-456.4: Develop advance intelligent programs that can process language
BEC-DS-456.5: Undertstand DAAL4Py framework

LIST OF EXPERIMENTS:

1. Introduction to Prolog- Installation, Syntax and Semantics
2. Write a program in Prolog to create simple knowledge base and query over it.
3. Write program for expert systems inferences using Prolog
4. Write a program for finding inferential relationship from family tree using Prolog
5. Write program for simple reflex response generation in Prolog
6. Write a program to conduct uninformed and informed search using IDP
7. Write program to conduct game search using Minimax Algorithm approach in IDP
8. Write a program to infer from the Bayesian network
9. Write a program for character recognition using IDP
10. Write program for Image classification using IDP libraries
11. Write program for TIC-TAC-TOE game playing automated system using IDP

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. To develop character recogniser
2. To develop animal image classifier (classify dogs and cats images)
3. To design line follower Robot prototype
4. To develop Robot that detects obstruction on its path and finds alternate path

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-456)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-456.1	1	2	2	2	1	-	-	-	-	-	-	2	2	2	1	-
BEC-DS-456.2	1	2	3	2	2	-	-	-	-	-	-	3	2	2	1	-
BEC-DS-456.3	2	3	3	3	3	-	-	-	-	-	-	3	2	3	2	-
BEC-DS-456.4	1	2	2	2	2	-	-	-	-	-	-	2	2	2	1	-
BEC-DS-456.5	2	3	3	2	3	-	-	-	-	-	-	3	2	3	2	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BMA-308: MATHEMATICS-3 TRANSFORM AND STATISTICS

Periods/week Credits	Max. Marks : 200
L: 2 T: 0 2	Continuous Evaluation: 100
Duration of Examination: 3 Hrs	End Term Examination: 100

Pre-requisite: Knowledge of basic concepts of probability of Intermediate level

Course Type: Basic Sciences

Course Outcomes: The course will enable the student to-

BMA-308.1 Understand the role of transformation in engineering.
BMA-308.2 Define wavelet and Z- transforms.
BMA-308.3 Apply the statistical tools to engineering problems.
BMA-308.4 To analyze small and large samples by using various statistical tests.

Unit 1: Transform Calculus-1(7 Lectures)

Laplace Transform, Laplace transform of periodic functions, inverse laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier Transform, Fourier sine and cosine transform, Fourier finite transform, Solution of differential equation by Fourier transform.

Unit 2: Transform Calculus-2(6 Lectures)

Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

Unit 3: Applied Statistics(8 Lectures)

Probability distributions: Binomial, Poisson and Normal, evaluation of statistical parameters for these three distributions, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Unit 4: Sampling Theory(6 Lectures)

Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations, Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Distribution of Continuous Evaluation:

Sessional-I	30%
Sessional-II	30%
Assignment/Tutorial	20%
Class Work/ Quiz	20%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Assignments, Sessional and End Semester Examination paper will consist of various difficulty levels to accommodate the different capabilities of students. Assessment should cover all course outcomes and upper limit for lower order skills will be 40% (for knowledge-oriented questions). However, weightage for different cognitive levels in the question papers can vary.

Instructions for paper setting: The paper setter must ensure the coverage of entire syllabus while setting the question papers and mention the learning outcomes across each section to be measured by the examination. Weightage of the sections may vary as per the number of respective lecture hours mentioned in the syllabus.Action verbs should be used from Bloom's Taxonomy while designing question papers.

Course Articulation Matrix:

CO statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BMA-308.1	3	3	1	2	2	-	-	-	-	-	-	2	-	-	-
BMA-308.2	3	3	1	2	2	-	-	-	-	-	-	1	-	-	-
BMA-308.3	3	3	2	2	3	-	-	-	-	-	-	2	-	-	-
BMA-308.4	3	3	1	1	2	-	-	-	-	-	-	1	-	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-521: VHDL

Periods/week Credits	Max. Marks	: 200
L: 3 T: 0 3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Semester Examination	: 100

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-514.1. Explain the concepts of Digital Design and modeling.

BEC-DS-514.2. Apply basic constructs of Verilog HDL to design digital systems.

BEC-DS-514.3. Design combinational and sequential logic circuits using Verilog HDL in gate level, behavioral and dataflow styles of modeling.

BEC-DS-514.4. Implement important techniques such as Overriding parameters and Time Scales used in Verilog to design different digital systems.

PART-A

Unit 1 :Introduction to Digital Design and Modeling Concepts

1.1 Evolution of CAD, emergence of HDLs and comparison.
1.2 Introduction to digital circuit design flow,
1.3 Top-down and bottom-up design methodology
1.4 Differences between modules and module instances, parts of a simulation
1.5 Design block, stimulus block.

Unit 2:Basic Concepts

2.1 Lexical conventions, data types, Variables and other language constructs
2.3 System tasks, compiler directives
2.4. Modules and Ports: Module definition, port declaration
2.5 connecting ports, hierarchical name referencing.

Unit 3: Gate Level Modeling

3.1 Modeling using basic Verilog gate primitives
3.2 Description of and/or andbut/not type gates
3.3 Rise, fall and turn-off delays, min, max, and typical delays.
3.4 Gate Level modeling examples of simple combinational and sequential logics

PART-B

Unit 4: Dataflow Modeling

4.1 Continuous assignments
4.2 Delay specification, expressions

4.3 Operators, operands, operator types.
4.4 Dataflowlmodeling examples of simple combinational and sequential logics

Unit 5: BehavioralModeling

5.1 Structured procedures, initial and always
5.2 Blocking and nonblocking statements, delay control
5.3 Generate statement, event control
5.4 Conditional statements, multiway branching, loops, sequential and parallel blocks.
5.5 Behavioralmodeling examples of simple combinational and sequential logics

Unit 6: Important Modeling Techniques

6.1 Tasks and Functions
6.2 Procedural Continuous Assignments
6.3 Overriding Parameters
6.4 Conditional compilation and Execution
6.5 Time Scales
6.6 Useful System Tasks

Text Books:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.
2. Kevin Skahill, "VHDL for Programmable Logic", PHI/Pearson education, 2006.

Reference Books:

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

Software required/Weblinks:

XILINX ISE Design Suite
http://www.nptelvideos.in/2012/12/digital-vlsi-system-design.html

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-521)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-521.1	1	3	3	3	3	2	-	-	-	-	-	1	3	3	3	3
BEC-DS-521.2	1	3	3	3	3	1	-	-	-	-	-	1	3	3	3	3
BEC-DS-521.3	-	2	3	3	3	3	2	-	-	-	-	2	3	3	3	3
BEC-DS-521.4	-	3	3	3	3	1	-	-	-	-	-	-	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-522: WIRELESS COMMUNICATION

Periods/week Credits		Max. Marks : 200
L: 3+2* T: 0	3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Pre-requisites: Basics of Communication
Course Type: Program Core

Course Outcomes
The student will be able to

BEC-DS-522.1. Understand the basic concepts and architecture used in mobile radio communication systems.
BEC-DS-522.2. Comprehend various standards, technologies and architecture used in Analog and Digital Mobile Radio systems.
BEC-DS-522.3. Analyze various mechanisms of propagation and fading in mobile radio channels and their impact on designing the radio systems.
BEC-DS-522.4. The students will be able to comprehend various concepts of equalization and diversity techniques and their applications in designing the mobile radio systems.

PART- A

Unit 1: Introduction to Wireless Communication Systems

1.1 Introduction to wireless communication: Block diagram, terminologies
1.2 Examples: paging system, cordless, cellular telephone system
1.3 Evolution of wireless generations: 1G: Features of AMPS, NAMPS, NTT, NMT
1.4 2G: GSM system architecture
1.5 GSM radio Subsystem, GSM channel types, Signal processing in GSM, IS -95 standard

Unit 2: Multiple Access Techniques for wireless communication

2.1 FDMA, TDMA
2.2 Spread spectrum multiple access: FHMA, CDMA, Space division multiple access
2.3 Packet- radio protocols: Introduction, Slotted ALOHA and Pure ALOHA

Unit 3: Modern Wireless communication System

3.1 2.5G: Features of HSCSD, EDGE, GPRS, IS-95B
3.2 3G-3GPP: WCDMA, TD-CDMA, EDGE
3.3 3GPP2: CDMA 2000-1XRTT, CDMA 2000 1X, EV-DV-DO, CDMA 2000- 3XRTT
3.4 4G, LTE
3.5 WLAN, Wi-MAX, Bluetooth and PAN

PART- B

Unit 4: System Design Concept

4.1 Frequency reuse, channel assignment strategies: Fixed channel assignment and Dynamic Channel assignment
4.2 Handoff strategies, Practical handoff consideration, Soft and Hard handoff
4.3 Interference and system capacity: Adjacent and Co-channel interference
4.4 Improving coverage and capacity in cellular systems: Cell splitting, Sectoring, Microcell zone concept

Unit 5: Mobile Radio Propagation & Fading

5.1 Large scale path loss: propagation mechanisms: reflection, diffraction, scattering Free Space loss-model
5.2 Ground reflection (Two-Ray) model
5.3 Practical link budget design using path loss models: log distance path loss model, log normal shadowing
5.4 Small scale fading & multipath propagation: Factors affecting small scale fading, Doppler Shift
5.5 Types of fading channels (Flat, selective, slow and fast)
5.6 Out door models (Okumara model, Hata model)

Unit 6: Equalization & diversity techniques

6.1 Equalization: Introduction, Fundamentals of equalization, equalizer in communication receiver
6.2 Types of equalization, linear equalizer (Linear transversal equalizer)
6.3 Diversity techniques: Introduction, types (Time diversity, Space diversity, Frequency diversity)
6.4 Rake receivers

Text Books/Reference Books:

1. Wireless Communication: Principles and Practice: T.S. Rappaport, 2nd Edition, Pearson Education,2010.
2. Mobile communications Design and fundamentals: William C. Y. Lee, 2nd Edition, Wiley, 1993.
3. Mobile and Personal Communication Systems and Services: R. Pandya, 2nd Edition, PHI, 2004.

Software Required/Weblinks:

MATLAB and Simulink
Network Simulation tools(NS2)
nptel.ac.in/courses/117102062
https://www.youtube.com/watch?v=QHDxbbc1GWs

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-522)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-522.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-522.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-522.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-522.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-503: ARTIFICIAL INTELLIGENCE

Periods/week	Credits	Max. Marks	: 200
L :3 T: 0	3.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Course Type: Elective

Course Outcomes: The Students will be able-

BCS-DS-503.1. To list the basic problems solved using Artificial Intelligence techniques.
BCS-DS-503.2. To explain artificial intelligence techniques and their application areas.
BCS-DS-503.3. To practice various methods of knowledge representation and reasoning.
BCS-DS-503.4. To examine different artificial techniques and learning systems.
BCS-DS-503.5. To judge the concepts of knowledge acquisition in perspective of expert system and intelligent agents.
BCS-DS-503.6. To create a basic expert system.

PART-A

Unit-1: Introduction to AI and its Languages

1.5 Foundation and history of AI,
1.6 AI programming languages,
1.7 Introduction to AI languages: Elements of LISP and PROLOG Languages.
1.8 AI problems and techniques, formulation of problem,
1.9 Problem characteristics. Production System and Production System characteristics,

Unit-2: AI Search Techniques

2.1. Heuristic Search Techniques: Generate and Test,
2.2. Hill Climbing, Steepest Hill Climbing,
2.3. Best First Search, A*,
2.4. Problem Reduction, AO*,
2.5. Constraint Satisfaction,
2.6. Means-Ends Analysis.
2.7. Optimization and search such as stochastic annealing and genetic algorithm.

Unit-3: Knowledge Representation

3.1 Knowledge-Representation, KR Approaches and Issues,
3.2 Procedural and Declarative knowledge,
3.3 Predicate Logic: Representation and resolution,
3.4 Logic programming, Forward and Backward Reasoning,
3.5 Slot and Filler structures: Semantic Nets,
3.6 Frames,
3.7 Conceptual Dependency and
3.8 Scripts.

PART-B

Unit-4: Reasoning
4.1 Limitations of Monotonic Systems,
4.2 Basic Concepts of Non-Monotonic Reasoning Systems,
4.3 Default Reasoning, Probability Based Reasoning, Bayes Theorem,
4.4 Certainty factors and Dempster-Shafer Theory of Evidential reasoning
4.5 Fuzzy Based Reasoning Systems.

Unit-5: Expert Systems and Intelligent Agents
5.1 Definition and Characteristics of Expert Systems,
5.2 Rule Based Systems Architecture, Knowledge Acquisition Concepts, Inference Engine,
5.3 Intelligent Agents: Definition, Structure of Agents, Types of Agents,
5.4 Intelligent System.

Unit-6: Applications
6.1 Application to Game: Game tree,
6.2 Min-max search procedure,
6.3 Alpha beta pruning.
6.4 Natural Language Processing: Introduction, syntactic, semantic, discourse and pragmatic processing,
6.5 Robotics.

Text Books / Reference Books:

6. Elain Rich and Kevin Knight (2009), Artificial Intelligence, 3rd edition, Tata McGraw Hill.
7. Stuart J.Russel and Peter Norvig (2009), Artificial Intelligence-A modern approach: 3rd edition, Pearson.
8. Patrick Henry Winston (1992), Artificial Intelligence , 3rd edition, , Pearson.
9. George F Luger, (2009), Artificial Intelligence :Structures and Strategies for Complex Problem Solving , University of New Mexico,6th edition, Pearson.
10. V S Janakiraman, Parerback (2005), Foundations of Artificial Intelligence And Expert Systems : 3rd edition, Macmillan India Limited

Software required/Weblinks:
http://artint.info/html/ArtInt_351.html
http://www.tutorialspoint.com/artificial_intelligence/
http://www.compinfo-center.com/tpai-t.htm

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BCS-DS-503)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BCS-DS-503.1	2	2	1	2	2	1	1	1	2	2	2	2				
BCS-DS-503.2	2	3	2	3	3	2	2	2	2	3	2	3				
BCS-DS-503.3	3	2	2	2	2	2	1	1	3	2	3	3				
BCS-DS-503.4	3	3	2	3	3	1	1	1	3	1	2	2			1	
BCS-DS-503.5	2	1	1	2	1	2	2	1	2	1	1	3			2	
BCS-DS-503.6	2	1	3	1	3	3	3	3	3	3	3	3	3			

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-716: Android

Periods/week Credits	Max. Marks	: 200
L :3 T: 0 3.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Semester Examination	: 100

Pre-requisites:
Course Type: Program Electives

Course Outcomes

The students will be able to

BEC-DS-716.1. Understand the basic concepts of Android.
BEC-DS-716.2. Appreciate various applications of Android.
BEC-DS-716.3 Comprehend the Activities, Views, Fragments and Intents.
BEC-DS-716.4.Appreciate Android user interface and design user interface with views.

PART-A

Unit 1: Getting started with Android Programming

1.1 Introduction, Versions, Features, Architecture
1.2 Android Devices in the Market, Obtaining the Required Tools
1.3 Android SDK: Installing the Android SDK Tools
1.4 Configuring the Android SDK Manager, Eclipse, Android Development Tools (ADT)

Unit 2: Activities, Fragments and Intents

2.1 Understanding Activities, Applying Styles and Themes to an Activity, Hiding the Activity Title
2.2 Displaying a Dialog Window, Displaying a Progress Dialog
2.3 Linking Activities Using Intents, Returning Results from Intent, Passing Data Using an Intent Object
2.4 Fragments, Adding Fragments Dynamically, Life Cycle of a Fragment
2.5 Calling Built-In Applications Using Intents, Understanding the Intent Object, Using Intent Filters

Unit 3: Getting to know the Android user interface

3.1 Understanding the Components of a Screen, Views and View Groups
3.2 Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout
3.3 Scroll View, Adapting to Display Orientation, Anchoring Views
3.4 Resizing and Repositioning, Managing Changes to Screen Orientation
3.5 Persisting State Information during Changes in Configuration, Detecting Orientation Changes
3.6 Controlling the Orientation of the Activity, Utilizing the Action Bar
3.7 Adding Action Items to the Action Bar, Customizing the Action Items and Application Icon

PART-B

Unit 4: Designing user interface with views

4.1 Using Basic Views, TextView View, Button, Image Button, Edit Text, Check Box
4.2 Toggle Button, Radio Button, and Radio Group Views
4.3 Progress Bar View, Auto Complete TextView View, Using Picker Views, Time Picker View, Date Picker View
4.4 Using List Views to Display Long Lists, ListView View, Using the Spinner View
4.5 Understanding Specialized Fragments, Using a List Fragment, Dialog Fragment and Preference Fragment

Unit 5: Displaying Pictures and Menus with views

5.1 Using Image Views to Display Pictures, Gallery and ImageView Views
5.2 Image Switcher, Grid View, Using Menus with Views
5.3 Creating the Helper Methods, Options Menu, Context Menu
5.4 Some Additional Views, Analog Clock and Digital Clock Views, Web View

Unit 6: Data Persistence

6.1 Saving and Loading User Preferences, Accessing Preferences Using an Activity
6.2 Programmatically Retrieving and Modifying the Preferences Values
6.3 Changing the Default Name of the Preferences File
6.4 Persisting Data to Files, Saving to Internal Storage

Text Books/Reference Books:

1. Beginning Android 4 Application Development: Wei-Meng Lee, 3^{rd} Edition, Wiley publication, 2010.
2 Android Application Development (With Kitkat Support): Pradeep Kothari, 1^{st} Edition, Wiley publication, 2014.
3. Android Programming: The Big Nerd Ranch Guide (Big Nerd Ranch Guides): Bill Philips & Brian Hardy, 1^{st} Edition, Pearson Technology Group, 2013.
4. Android Design Patterns: Interaction Design Solutions for Developers: Greg Nudelman, 1^{st} Edition, Wiley publication, 2013.

Software required/Weblinks:

Android studio
ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-851-advanced-data-structures-spring-2012/lecture-videos/session-1-persistent-data-structures/#vid_playlist

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-716)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-716.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-716.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-716.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-716.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-404 :DATABASE MANAGEMENT SYSTEMS

Periods/week	Credits	Max. Marks	: 200
L :3 T: 1	4.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Term Examination	: 100

Pre-Requisite: Basic Knowledge of computers

Course Type: Program Core

Course Outcomes: Students will be able to-
BCS-DS-404.1. recognize the importance of database management system, its components and architecture.
BCS-DS-404.2. describe different data models, and conceptual E-R model, able to understand the concepts transaction processing and concurrency control.
BCS-DS-404.3. apply essential DBMS concepts such as: information storage system, database security, integrity, concurrency.
BCS-DS-404.4. use multiple query language techniques, write relational algebra expression and optimization of query.
BCS-DS-404.5. evaluate database schema and its normalization.
BCS-DS-404.6. build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.

PART- A

Unit-1: Database System Architecture
1.1 Data Abstraction, Data Independence,
1.2 Data Definition Language (DDL), Data Manipulation Language(DML),
1.3 Entity-Relation Model,
1.4 Network Model, Relational and object oriented data models,
1.5 Integrity Constraints,
1.6 Data Manipulation Operation.

Unit-2: Relational database Design, query languages and Optimization
2.1 Relational Database Design, Domain and Data Dependency, Armstrong's axioms,
2.2 Normal Forms, Dependency preservation, Lossless Design,
2.3 Relational Query Languages, Relational algebra,
2.4 Tuple and Domain Relational Calculus,
2.5 SQL, DDL, and DML constructs,
2.6 Open Source and Commercial DBMS-MYSQL, ORACLE, DB2, SQL Server,
2.7 Query Processing and Optimization, Evaluation of Relational Algebra Expression,
2.8 Query equivalence, Join Strategies, Query Optimization Algorithms.

Unit-3: Storage Strategies
3.1 Indices,
3.2 B-trees,
3.3 Hashing.

PART –B

Unit-4: Transaction Processing
4.1 Transactions, ACID properties, concurrency control,
4.2 Serializability of scheduling, Locking and timestamp based scheduler,
4.3 Multi-version and optimistic concurrency control schemes,
4.4 Database Recovery.

Unit-5: Database Security
5.1 Authentication, Authorization and access control,
5.2 DAC, MAC and RBAC models,Intrusion Detection,
5.3 SQL injection.

Unit-6: Advanced Topics
6.1 Object oriented and object relational databases,
6.2 Logical databases, Web Databases
6.3 Distributed databases, Data warehousing and Data Mining.

Text Books /Reference Books:

1. A. Silberschatz, H.F. Korth and S. Sudarshan,1997,Database System Concepts, 3rdEd.,TMH.
2. R. Elmasri and S.B. Navathe, 2000, Fundamentals of Database Systems, 3rd Ed, AW.
3. C.J. Date, 2000, An Introduction to Database Systems, 7th ED., Addison-Wesley.
4. J.D. Ullman, Principles of Database and Knowledge-Base system: Vol.1, Computer science Press.
5. S K Singh, Database Systems: Concepts, Design and Application, Pearson.
6. Ivan Bayross, SQL, PL/SQL The Programming Language of Oracle, 2nd Ed., BPB Publication.
7. Allen and Christopher, Oracle Database 10g PL/SQL 101, 3rd edition, TMG.
8. Bipin Desai, 1991, Introduction to Database Management System, Galgotia Pub.
9. Serge Abiteboul, Richard Hull, Victor Vianu, Foundations of Databases : Reprint Addition-Wesley.

Software required/Weblinks:

MySQL/Oracle

www.tutorialpoint.com

www.nptel.com

www.w3schools.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX :

CO Statement (BCS-DS-404)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-DS-404.1	2	3	1	2	3	2	2	1	2	2	2	2	2	3	3
BCS-DS-404.2	3	2	2	2	2	3	3	2	3	2	3	3	2	2	3
BCS-DS-404.3	2	1	2	1	3	2	1	1	2	1	2	2	2	3	2
BCS-DS-404.4	1	2	3	3	2	1	1	1	3	1	2	2	3	2	2
BCS-DS-404.5	1	1	1	3	1	2	2	1	2	1	1	3	2	3	3
BCS-DS-404.6	1	1	3	1	3	3	3	2	3	3	1	3	1	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

HM 506: FRENCH I

Periods/week Credits	Max. Marks : 100
P:2 2	Continuous Evaluation: 50
Duration of Examination: 1.5 Hrs	End Semester Examination: 50

Course Type: Elective

Course Outcomes:
The student will be able to:

HM-506.1. Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
HM-506.2. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, usingsimple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.
HM-506.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar top relying on repetition and extra linguistic support when needed. Describe themselves, otpeople, familiar places and objects in short discourse using simple sentences and basic vocabulary.
HM-506.4. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.
HM-506.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

PART-A

Unit 1:Saluer et épelerl'alphabet

1.1 Les Salutations & forms of politeness
1.2 Alphabets

Unit 2: Usage de Vous et de Tu

2.1 Taking leave expressions
2.2 Les pronomssujets
2.3 Basic Questions

Unit 3:Présentez-vous

3.1 Les verbes ER
3.2 Self introduction
3.3 Décrivezvotreami(e)

PART-B

Unit 4: Identifier un nombre, compter

4.1 Les noms
4.2 VerbesAvoir, Etre, Aller & Faire
4.3 Les nombres

Unit 5: Demander/ donner l'explications

5.1 Les articles define et indefini
5.2 Les mois de l'annee
5.3 Les jours de la semaine

Unit 6: Parler des saisons et demander l'heure

6.1 Time
6.2 Weather
6.3 Unseen Passage

Text Books/Reference Books/ Suggested Readings:

1. Annie Berthet, Catherine Hugot, Veronique M Kizirian, 2006, Alter Ego Level One Textbook, Hachette Publications
2. Mahitha Ranjit, 2014, Apprenons Le Francais II & III, Saraswati Publications

Weblinks:
www.bonjourfrance.com
www.allabout.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

Evaluation Tools:
Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (HM–506)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
HM-506.1	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-506.2	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-506.3	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-506.4	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-506.5	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

HM 507: GERMAN I

Periods/week	Credits	Max. Marks : 100
P:2	2	Continuous Evaluation : 50
Duration of Examination: 1.5 Hrs		End Semester Examination: 50

Course Type: Elective

Course Outcomes:

HM-507.1. Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.
HM-507.2. Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.
HM-507.3. Students will be able to identify key details in short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed.
HM-507.4. Students will be able to discuss likes and dislikes, understand simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed
HM-507.5. Students will be able to differentiate certain patterns of behavior in the cultures of theGerman-speaking world and the student’s native culture.

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PART-A

Unit 1: Begrüßungen

1.1 Salutations/Greetings
1.2 Introduction

Unit 2: sichvorstellen und Zahlen

2.1 Introduction
2.2 Alphabets
2.3 Numbers 1-20

Unit 3: Berufe/ Pronomen

3.1 Personal pronouns
3.2 Hobbies and professions

PART-B

Unit 4: Café

4.1 Café related vocabulary and dialogues
4.2 Revision personal pronouns

Unit 5: Café dialog

5.1 Café related vocabulary and dialogues
5.2 Common verbs and their conjugations

Unit 6: Zeit und Monate

6.1 Time
6.2 Days
6.3 Months

Text Books/Reference Books:

1. Hermann Funk , 2011, Studio D A1, Cornelson Publication
2. TangaramAktuell A1, Kursbuch&Arbeitsbuch, 2011, Hueber
3. Stefanie Dengler, Paul Rusch et. A,lNetzwerk, Klett

Weblinks:

http://www.nthuleen.com/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

Evaluation Tools:
Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (HM-507)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
HM-507.1	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-507.2	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-507.3	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-507.4	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-507.5	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

HM 508: SPANISH 1

Periods/week Credits	Max. Marks	: 100
P:2 2	Continuous Evaluation	: 50
Duration of Examination: 1.5 Hrs	End Semester Examination: 50	

Course Type: Elective

Course Outcomes

HM-508.1. Students will be able to exchange greetings and introductions using formal and informal expressions and students will be able to ask and answer simple questions.

HM-508.2. Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary and students will be able to discuss likes and dislikes understand simple conversations about familiar topics.

HM-508.3. Students will be able to identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed and students will be able to offer basic descriptions of self, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

HM-508.4. Students will be able to provide basic information about familiar situations and topics of interest and students will be able to express or/and justify opinions using equivalents of different verbs.

HM-508.5. Students will be able to differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and student's native culture.

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PART-A

Unit 1: Introduction to Spanish and SER

1.1 Presentation on Spanish language
1.2 Greetings and goodbyes
1.3 Spanish letters
1.4 Introduction of Verbo SER

Unit 2: Verb Ser, Nationality, Profession and Counting

2.1 Uses of Verbo SER
2.2 Adjectives related to Verbo SER.
2.3 Introduction of Nationality
2.4 Professions and vocabulary related to professions.
2.5 Counting till number 20

PART-B

Unit 3: Articles, Interrogative and Estar

3.1 Introduction of Articles and Indefinite articles

3.2 Interrogatives
3.3 Introduction of Verbo Estar

Unit 4:Estar, Preposition, Tener and Self Introduction

4.1 Uses of Verbo ESTAR and adjectives related to it
4.2 Prepositions related to the positioning of an object
4.3 Tener &its uses
4.4 Self – introduction

Unit 5 : Day, Month and Regular AR verb

5.1 Days
5.2 Months
5.3 Introduction to regular –AR verbs

Text Books/Reference Books:

1. Eric V Greenfield, 1971, Spanish Grammar , Barnes and Noble
2. Jesus Sanchez Lobato and Isabel Santos Gargallo, 2006, NuevoEspanol sin fronteras 1 + Workbook + CD, Goyal Saab, ELE & SGEL

Weblinks:
http://studyspanish.com/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

Evaluation Tools:
Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (HM-508)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
HM-508.1	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-508.2	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-508.3	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-508.4	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-508.5	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1

SEMESTER 6

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BCS-DS-427A: Python

Periods/week	Credits	Max. Marks : 200
L :2 T: 0	2.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Pre-Requisite: Basic Knowledge of computers &Object Oriented Programming (BCS-DS-302)

Course Type: Program Electives

Course Outcomes: Students will be able to-

BCS-DS-427A.1. Understand the basic concepts of Python programming such as data types, tuples, Lists, dicts, basic operators, and functions
BCS-DS-427A.2. Demonstrate knowledge with the Python Program Development Environment (PPDE).
BCS-DS-427A.3. Describe the principles of object-oriented programming using Python
BCS-DS-427A.4. Perform high-level mathematical computing using the NumPy package and library of Mathematical Functions
BCS-DS-427A.5. Solve problems requiring the writing of well-documented programs in the Python language, including use of the logical constructs.
BCS-DS-427A.6. Design, code, and test Python programs on some mini projects

PART-A

UNIT-1: Parts of Python Programming Language

1.1 Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity,
1.2 Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language,
1.3 **Control Flow Statements,** The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement,
1.4 The while Loop, The for Loop, The continue and break Statements,
1.5 Built-In Functions, Commonly Used Modules,
1.6 Function Definition and Calling the Function, The return Statement and void Function,
1.7 Scope and Lifetime of Variables, Default Parameters,

UNIT-2: Strings, List Methods & exception

2.1 Creating and Storing Strings, Basic String Operations,
2.2 Accessing Characters in String by Index Number, String Slicing and Joining,
2.3 String Methods, Formatting Strings,
2.4 Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists,
2.5 Built-In Functions Used on Lists, List Methods, The del Statement.

2.6 The anatomy of exception
2.7 Python Built-in Exceptions

UNIT-3: Python Data Structures

3.1 Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries,
3.2 Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement,
3.3 **Tuples and Sets,** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples,
3.4 Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries
3.5 Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozenset

PART-B

UNIT-4: Working with NumPy:

4.1 Creating NumPy arrays
4.2 Indexing and slicing in NumPy
4.3 Downloading and parsing data
4.4 Creating multidimensional arrays
4.5 NumPy Data types
4.6 Array tributes
4.7 Indexing and Slicing
4.8 Creating array views copies
4.9 Manipulating array shapes I/O

UNIT-5: Files Handling

5.1 Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,
5.2 The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules,
5.3 **Regular Expression Operations,** Using Special Characters, Regular Expression Methods,
5.4 Named Groups in Python Regular Expressions, Regular Expression with glob Module.

UNIT-6: Object-Oriented Programming

6.1. Classes and Objects, Creating Classes in Python, Creating Objects in Python,
6.2. The Constructor Method, Classes with Multiple Objects,
6.3. Class Attributes versus Data Attributes, Encapsulation,
6.4. Inheritance, The Polymorphism

Text Books / Reference Books:

1. Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor Francis, 2018. ISBN-13: 978-0815394372.
2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058.
3. AurelienGeron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition,O'Reilly Media, 2017. ISBN – 13: 978-1491962299.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

5. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python", 2nd Edition, O'Reilly Media, 2018. ISBN-13: 978-1491991732.

Software required/Weblinks:

https://www.python.org

https://www.coursera.org/python

https://www.edx.org/python

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

End Semester Examination

COURSE ARTICULATION MATRIX:

CO Statement (BCS-DS-427A)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-DS-427A.1	3	3	2	3	1	2	1	1	1	1	1	3	3	3	3
BCS-DS-427A.2	3	3	2	2	2	2	1	1	1	1	1	3	3	3	3
BCS-DS-427A.3	3	3	3	2	2	1	1	1	1	1	1	3	3	3	3
BCS-DS-427A.4	3	3	3	1	1	2	1	1	3	1	1	3	3	3	3
BCS-DS-427A.5	3	3	2	2	2	1	1	1	1	1	1	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BCS-DS-479A: Python Lab

Periods/week	Credits	Max. Marks : 100
P: 2	1.0	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination: 50

Co-Requisite: Python (BCS-DS-427A)
Course Type: Program Electives

Course Outcomes: Students will be able to-

BCS-DS-479A.1. To understand the basic concepts of Python programming such as data types, tuples, Lists, dicts, basic operators, and functions
BCS-DS-479A.2. To demonstrate knowledge with the Python Program Development Environment (PPDE).
BCS-DS-479A.3 To Describe the principles of object-oriented programming using Python
BCS-DS-479A.4. To perform high-level mathematical computing using the NumPy package and library of Mathematical Functions
BCS-DS-479A.5. Solve problems requiring the writing of well-documented programs in the Python language, including use of the logical constructs.
BCS-DS-479A.6. To Design, code, and test Python programs on some mini projects

List of experiments-

1. Write a Python program which accepts the radius of a circle from the user and compute the area.
2. Write a Python program to get the volume of a sphere with radius 6.
3. Write a Python program to find whether a given number (accept from the user) is even or odd, print out an appropriate message to the user.
4. Write a Python program to get the least common multiple (LCM) of two positive integers.
5. Write a Python program to create all possible strings by using 'a', 'e', 'i', 'o', 'u'. Use the characters exactly once.
6. Write a Python program to solve the quadratic equation.
7. Write a Python program to convert Celsius to Fahrenheit.
8. Write a Python program to find factorial of a Number.
9. Write a Python program to find the resolution of JPEG image.
10. Write a Python Program to generate Random Numbers.
11. Write a Python Program to find ASCII value of character present in a string.
12. Write a Python Program to find largest element in an array.
13. Write a Python Program to check if a given array is Monotonic or not.
14. Write a Python Program to find the length of the list.
15. Write a Python Program to reverse the given list.
16. Write a Python Program to count positive and negative numbers in a list.
17. Write a Python Program to check if a string is palindrome or not.
18. Write a Python Program to split and join a string.
19. Write a Python Program to sort Python Dictionary by Key or Value.
20. Write a Python Program to sort list of dictionaries by values using lambda function.
21. Write a Python Program to create grade calculator.

22. Write a Python Program using dictionary to find mirror characters in a string.
23. Write a NumPy program to test whether none of the elements of a given array is zero.
24. Write a NumPy program to test element-wise for positive or negative infinity.
25. Write a NumPy program to create an array of 10 zeros,10 ones, 10 fives.
26. Write a NumPy program to create an array of all the even integers from 30 to 70
27. Write a NumPy program to compute sum of all elements, sum of each column and sum of each row of a given array
28. Write a Python Program to print double sided stair-case pattern.
29. Write a Python Program for Binary Search(Recursive and Iterative) algorithm.
30. Write a Python Program for Bubble Sort.
31. Write a Python Program to convert time from 12 hour to 24 hour format.
32. Write a Python Program to find the largest prime factor of a number.
33. Write a Python Program for Tower of Hanoi.
34. Write a Python Program for Triangular Matchstick Number.
35. Write a Python Program to copy odd lines of one file to other.

Text Books / Reference Books:

1. Brown M. C. 2018,The Complete Reference,McGraw Hill Education,Forth edition
2. Martelli A. 2003,Python in a Nutshell ,O'Reilly,First edition

Software required/Weblinks:

https://www.python.org

https://www.geeksforgeeks.org › python-programming-language

https://www.w3schools.com › python

https://www.tutorialspoint.com › python

https://docs.python.org/3.8/tutorial/introduction.html

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Evaluation Tools:

Experiments in lab

File work/Class Performance

Viva (Question and answers in lab)

Small Project

End Semester Practical Examination

COURSE ARTICULATION MATRIX:

CO Statement (BCS-DS-479A)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-DS-479A.1	-	1	-	-	-	-	-	-	-	-	-	-	1	2	3
BCS-DS-479A.2	1	-	-	-	-	2	-	-	-	-	-	-	1	3	-
BCS-DS-479A.3	-	3	3	-	-	-	2	-	-	-	-	-	1	3	-
BCS-DS-479A.4	1	-	3	-	-	2	-	-	1	2	-	-	1	2	2
BCS-DS-479A.5	-	2	-	1	-	-	1	-	-	-	1	1	2	-	3
BCS-DS-479A.6	1	2	3	-	-	-	3	2	2	-	2	2	1	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-606: DATA COMMUNICATION AND NETWORKING

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-606.1. Analyze the basic concepts of data communication and networking.
BEC-DS-606.2. Compare various types of data transmission techniques and understand the error detection and correction techniques
BEC-DS-606.3. Categorize different types of transmission media and networking devices.
BEC-DS-606.4. Discuss types of carrier systems, networks and protocols used in telecommunication.

Part-A

Unit 1: Introduction to Data Communication and Networking

1.1 Data communication: Definition, Block diagram including DTE &DCE
1.2 Standard organizations of data communication
1.3 Data transmission: serial transmission, parallel transmission
1.4 Overview of Networks- LAN, MAN, WAN, types of Topologies
1.5 Network Reference Models: OSI and TCP/IP including layers functions and protocol.
1.6 Various transmission media, Networking Devices (Hubs, Repeater, Switch, Bridges, Routers, Gateway)

Unit 2: Services of Data link layer

2.1 Error detection techniques: parity checks, cyclic redundancy check, Checksum
2.2 Error correcting codes: Hamming code, Protocol principles (error control, flow control)
2.3 Synchronous data link layer protocols-SDLC, HDLC and Asynchronous data link layer protocols – XMODEM, YMODEM, ZMODEM & KERMIT
2.4 Serial interface-RS-232, Parallel interface

Unit 3 Introduction to LANs & WANs

3.1 Overview of LAN: LAN standards, Channel access methods: CSMA, CSMA/CD, Token ring.
3.2 Ethernet: layered architecture, Fast Ethernet: layered architecture, Gigabit Ethernet (IEEE 802.3z): Overview and Specifications, Layered protocol architecture, MAC Layer and Frame Format, Applications
3.3 10GB Ethernet: Overview and Specifications, Layered protocol architecture and Applications
3.4 Introduction to WAN, WAN technologies: SONET/SDH
3.5 ATM: ATM cell, layered architecture, ATM signaling, addressing and applications
3.6 ISDN & B-ISDN: Technology Overview, Interfaces and Channels, Layered Protocol architecture and Frame Format

PART-B

Unit 4: Digital T-Carriers and Multiplexing

4.1 Introduction: TDM, PCM based TDM system, T-carriers, Bit vs. word interleaving
4.2 Synchronous and Statistical TDM, codec & combo chips
4.3 FDM, AT&T FDM hierarchy, formation of group, super group, master group & radio channel
4.4 European Digital Carrier System
4.5 Line encoding: NRZ (L), NRZ (I), Manchester, Differential Manchester, BP-AMI

Unit 5: Transport layer Protocols

5.1 Internet and transport layer: Introduction to Internet, Internet architecture
5.2 Internet Layer: IP Protocol, IP datagram, IP addressing
5.3 Protocols: ARP, RARP, ICMP and IGMP
5.4 IP routing and protocols: RIP, OSPF, and BGP
5.5 IPV6: Header format, Addressing, IPV4 verses IPV6, Introduction to Mobile IP.
5.6 Transport layer Protocols: TCP functions, segments and connections. UDP, TCP verses UDP

Unit 6: Application layer Protocols, **Network Management and Security**

6.1 Introduction to application layer and protocols: WWW, HTTP, DNS
6.2 E-Mail and protocols: SMTP, IMAP and MIME
6.3 File transfer protocols: FTP, TFTP and Voice over IP (VoIP)
6.4 Network management protocol: SNMP, V-LANs: architecture and applications
6.5 Data Encryption & Cryptographic techniques. Firewalls: types, architecture and applications, Internet Security protocol (IPSEC)

Text Books/Reference Books:

1. Behrouz A. Forouzan, 2006, Data Communication and Networking ,4th Edition, Tata McGraw-Hill.
2. Wayne Tomasi, Introduction to Data Communication and Networking, 3rd Edition, Pearson Education.
3. William Stalling, 2007, Data and Computer Communication, 8th Edition, Pearson Education.
4. Andrew S. Tanenbaum , 2003, Computer Networks, 2nd Edition, Pearson Education.

Software required/Weblinks:

nptel.ac.in/courses/106105082
nptel.ac.in/courses/106105081
nptel.ac.in/courses/117105076

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-606)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-606.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-606.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-606.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-606.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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PROJ-EC- 600: PROJECT PHASE-I

Periods/week	Credits	Max. Marks	: 50
P: 2	1	Continuous Evaluation	: 50

Course Type: Projects

Course Outcomes
The students will be able to:

PROJ-EC- 600.1. Explain the developmental tools of variousmicrocontrollers and their interfacing with input and output devices.
PROJ-EC- 600.2. Apply practical knowledge of GSM and Bluetooth modules.
PROJ-EC- 600.3. Design basic projects on Electronics and Communication Engineering domain.
PROJ-EC- 600.4. Identify their area of interest and do extensive literature survey on the same.
PROJ-EC- 600.5. Summarized report in the form of synopsis.

LIST OF FEW SUGGESTED PROJECTS

1. Interfacing L293 Motor Driver IC with 8051.
2. Interfacing Stepper Motor with Arduino.
3. Interfacing 7-segment display with AVR.
4. Interfacing Liquid Crystal Display (LCD) with ARM.
5. Interfacing Graphical Liquid Crystal Display (GLCD) with Arduino.
6. Interfacing Switch with 8051.
7. Interfacing Light Emitting Diode (LED) with ARM.
8. Interfacing temperature Sensor with Arduino.
9. Interfacing Analog To digital Convertor (ADC)with 8051.
10. Interfacing Global System for Mobile communication (GSM) Module with Arduino.
11. Interfacing Humidity Sensor with 8051.
12. Interfacing Relay with ARM.
13. Interfacing RTC with 8051.
14. Interfacing Keypad with 8051.

NOTE: Every student should design any one mini project from the above list or can choose any other project beyond the given list.

Assessment Tools:
Continuous Evaluation during Project Phase-I:

1. Attendance	: 10 marks
2. Literature survey	: 10 marks
3. Synopsis Submission	: 10 marks
4. Presentation Skills	: 5 marks
5. Innovation	: 5 marks
6. Regularity	: 5 marks
7. Viva	: 5 marks

Distribution of Continuous Evaluation:

Presentation/Viva	40%
Report	20%
Class Work/ Performance	20%
Attendance	20%

Course Articulation Matrix

CO Statement (PROJ-EC- 600)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
PROJ-EC- 600.1	3	-	3	3	3	-	-	-	-	-	2	2	2	2	2	2
PROJ-EC- 600.2	2	-	3	3	3	-	-	-	-	-	2	2	2	2	2	-
PROJ-EC- 600.3	2	3	3	3	3	2	2	1	2	2	2	2	2	2	3	2
PROJ-EC- 600.4	-	3	3	3	3	2	3	3	3	3	3	3	3	3	3	-
PROJ-EC- 600.5	-	3	2	3	3	2	2	3	3	3	3	3	3	-	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEE-DS-502: CONTROL SYSTEMS

Periods/week Credits	Max. Marks : 200
L: 3 T: 1 4	Continuous Evaluation : 100
Duration of Examination: 3 Hours	End Semester Examination : 100

Pre requisites: NIL
Course Type: Program Core

Course Outcomes
After completion of this course the students will be able to

BEE-DS-502.1 Model linear time invariant systems using transfer function and state space.
BEE-DS-502.2 Evaluate stability of linear time invariant systems both in time domain as well as frequency domain.
BEE-DS502.3 Analyze the response of first and second order system using test signals
BEE-DS-502.4 To design simple feedback controllers.

PART -A

Unit 1: Introduction to control problem (6 hours)

1.1 Industrial Control examples.
1.2 Mathematical models of physical systems.
1.3 Transfer function models of linear time-invariant systems.
1.4 Feedback Control: Open-Loop and Closed-loop systems.Benefits of Feedback,
1.5 Block diagram algebra,
1.6 Signal flow graph

Unit 2: Time Response Analysis (8 hours)

2.1 Standard test signals.
2.2 Time response of first and second order systems for standard test inputs.
2.3 Applicationof initial and final value theorem.
2.4 Design specifications for second-order systems based on thetime-response.
2.5 Concept of Stability. Routh-Hurwitz Criteria. Relative Stabilityanalysis.
2.6 Root-Locus technique.
2.7 Error Analysis

Unit 3: Concept of stability & Root Locus Technique (7 hours)

3.1 Concept of Stability.
3.2 Routh-Hurwitz Criteria.
3.3 Relative Stabilityanalysis.
3.4 Root-Locus technique.
3.5 Construction ofRoot-loci.
3.6 Effect of addition of poles and zeros on the stability

PART –B

Unit 4: Frequency-response analysis (6 hours)

3.1 Relationship between time and frequency response,

3.2 Polar plots,
3.4 Bode plots.
3.5 Nyquist stability criterion.
3.6 Relative stability using Nyquist criterion
3.7 Gain and Phase margin.
3.8 Closed-loop frequency response.

Unit 5: Introduction to Compensators & Controller Design (7 hours)
5.1 Necessity of compensation, Realization of lag and lead compensators
5.2 Realization of lag lead compensators,
5.3 Frequency-domain methods of design.
5.5 Proportional, Integral and Derivative Controllers
5.6Realization of PI, PID with first and second order systems
5.7 Nonlinear system–Basic concepts and analysis

Unit 6: Control System Components&State variable Analysis (8 hours)
5.1 Servomechanism & Servomotors
5.2 Synchros, Magnetic Amplifier
5.3 Stepper Motor
5.4 Concepts of state variables,
5.5 State Transistion Matrix, Transfer Function
5.8 Controllability & Observability

Text/References:

1. M.Gopal, 2012, ControlSystems:PrinciplesandDesign, McGrawHillEducation.
2. FaridGolnaraghi ,B. C. Kuo, 2014. Automatic Control System,Wiley.
3. K.Ogata, 2015, ModernControlEngineering,Pearson.
4. I. J. Nagrath and M. Gopal, 2017, Control Systems Engineering, New Age International.

Software required/Weblinks:
https://nptel.ac.in/courses/107/106/107106081/
https://nptel.ac.in/courses/108/103/108103007
https://nptel.ac.in/courses/108/107/108107115/
Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Se Sessional- I	30 30%
Se Sessional- II	30 30%
A Assignment	20 20%
C Class Performance	10 10%
At Attendance	10 10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BEE-DS-502.1	3	3	3	3	2	1	-	-	-	-	-	2	3	-	2	1
BEE-DS-502.2	3	3	3	3	2	2	1	1	1	-	-	2	2	-	2	1
BEE-DS-502.3	3	3	3	2	3	1	2	1	1	2	-	-	3	2	2	1
BEE-DS-502.4	3	2	2	3	3	2	1	2	1	-	-	2	3	2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BHM-MC-009: QAPD-III

Periods/week	Credits	Max. Marks	: 100
L:0 T:0 P :2	AP	Continuous Evaluation	: 50
Duration of Examination: 2 Hrs		End Semester Examination	:50

Course Type: HSMC

Course Outcomes

BHM-MC-009.1**.**Students will be able to recognize problem based on Modern Mathematics and Algebra
BHM-MC-009.2**.**Students will be able to solve basic to moderate level problems based on Mensuration and Geometry.
BHM-MC-009.3**.** Students will be able to calculate solution to logical reasoning.
BHM-MC-009.4**.**Students will get proficient with resume building and will be able to draft effective cover letters.
BHM-MC-009.5**.**Students will be able to participate effectively and confidently in a Group Discussion
BHM-MC-009.6**.** Students will be able to manage interviews effectively.

PART – A

Unit 1: Modern Mathematics and Algebra

1.1 Permutation and Combination

1.1.1 Principal of counting and Basic formulas
1.1.2 Arrangements, Selection and Selection + Arrangement.
1.1.3 Linear/Circular arrangements, Digits and Alphabetic Problems and Applications.

1.2 Probability

1.2.1 Events and Sample Space, Basic Formulas.
1.2.2 Problems on Coins, Cards and Dices.
1.2.3 Conditional Probability, Bayes' Theorem and their Applications.

1.3 Algebra

1.3.1 Linear & Quadratic equations
1.3.2 Mathematical inequalities
1.3.4 Maximum & Minimum Values
1.3.3 Integral Solutions

Unit 2: Geometry and Mensuration

2.1 Geometry

2.1.1 Basic geometry & Theorems, Lines & Angles
2.1.2 Polygons, Triangle and Quadrilaterals
2.1.3 Circles

2.2 Mensuration I- Areas

2.2.1 Different types of Triangles and their area and perimeter.
2.2.2Different types of Quadrilateral and their area and perimeter.
2.2.3Circumference and Area of Circle, Area of Sector and length of Sector.
2.2.4Mixed Figures and their Applications.

2.3 Mensuration II- Surface Areas and Volumes

2.3.1 Problems on Cubes & Cuboids, Cone, Cylinder and Sphere.
2.3.2 Prism and Pyramid.
2.3.3 Mixed Figures and their Applications.

Unit 3: Logical Reasoning
3.1 Linear Arrangement
3.2 Circular Arrangement
3.3 Puzzles

Part - B

Unit 4: Professional Writing
4.1. Profiling on Social Sites: LinkedIn, Facebook, Instagram
4.2. Cover Letter/Emails
4.3. Resume Writing

Unit 5: Group Discussions
5.1. Do's and Dont's of a Group Discussion
5.2. Roles played in a Group Discussion
5.3. Tips for Cracking a Group Discussion

Unit 6: Managing Interviews
6.1. Developing the employability mindset
6.2. Preparing for Self -Introduction
6.3. Researching the employer
6.4. Portfolio Management
6.5. Answering Questions in an Interview

Text Books/Reference Books:
1. Arun Sharma , 2017, Teach Your Self Quantitative Aptitude:, 1st Edition, McGraw Hills Education.
2. R S Aggarwal, 2017, A Modern Approach to Logical Reasoning, S Chand & Company Pvt Ltd
3. Yana Parker & Beth Brown , The Damn Good resume Guide
4. Ceri Roderick & Stephan Lucks, Interview Answers

Instructions for paper setting: Fifty MCQ will be set in total. Twenty five MCQ will be set from Part A and twenty five MCQ will be set from Part B. All questions will be compulsory. Each question will be of 1 mark. There will be no negative marking. Calculator will not be allowed.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

Course Articulation Matrix :

CO Statement (BHM-MC-009)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BHM-MC-009.1	1	-	-	-	-	1	-	-	-	-	-	1	-	-	1
BHM-MC-009.2	1	-	-	-	-	1	-	-	-	-	-	1	-	-	1
BHM-MC-009.3	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-
BHM-MC-009.4	-	-	-	-	-	-	-	1	-	3	-	1	-	-	-
BHM-MC-009.5	-	-	-	-	-	-	-	1	-	3	-	-	-	-	-
BHM-MC-009.6	1	-	-	-	-	1	-	-	-	-	-	1	-	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-505 MACHINE LEARNING

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation: 100
Duration of Examination: 3Hrs	End Semester Examination : 100

Course Type: Program Core

Course Outcomes

The students will be able to:

BEC-DS-505.1: Explain machine learning with its basics and applications.
BEC-DS-505.2: Learn the basics of descriptive and inferential statistics.
BEC-DS-505.3: Analyse the process of data collection and pre-processing of Data and understand the techniques of supervised regression.
BEC-DS-505.4: Appreciate the fundamentals of supervised classification and unsupervised clustering and create & use neural networks and deep neural networks

PART-A

Unit 1: Introduction to ML

1.1 What is Machine Learning? What is the Goal of Machine Learning?
1.2 Application of ML
1.3 Supervised vs Unsupervised Learning
1.4 Batch vs online learning
1.5 Instance based vs Model based learning
1.6 Training, Testing and Validation
1.7 Statistical Modelling of data for learning
1.8 Hyper-parameter tuning and model selection

Unit 2: Learn basic Descriptive and Inferential Statistics

2.1 Introduction to several statistical studies (mean, median, mode, standard deviation, variance, co-variance, correlation, etc.)
2.2 Central tendency, Variability, Standardizing
2.3 Normal Distribution, Sample Distribution
2.4 Hypothesis Testing, ANOVA
2.5 Correlation, Regression
2.6 Chi-Squared Test
2.7 Eigen Vectors and Eigen Values
2.8 Types of statistical errors- MAE, MSE, RMSE, R-Squared
2.9 IDP Python Toolkit: Numpy- Introduction, Methods, Implementation

Unit 3: Data Preprocessing

3.1 Data Collection
3.2 Variable Identification, Univariate and Multivariate analysis
3.3 Missing Value imputation, Outliers Treatment
3.4 Feature Selection, Feature Engineering
3.5 Dimensionality Reduction- concept and definition, benefits
3.6 IDP Python Toolkit: Pandas- Introduction, Methods, Implementation
3.7 IDP Python Toolkit: Matplotlib- Introduction, Methods, Implementation
3.8 IDP Python Toolkit: SciKit-Learn- Introduction, Methods, Implementation
3.9 Web Scraping: A case study

PART-B

Unit 4: Supervised Regression

4.1 Simple Linear Regression
4.2 Gradient Descent
4.3 Multiple Linear Regression
4.4 Polynomial Regression
4.5 Regularization (Lasso, Ridge)
4.6 SVM Regression

Unit 5: Supervised Classification

5.1 KNN Classification
5.2 Logistic Regression
5.3 SVM Classification
5.4 Naïve byes classifier
5.5 Decision Tree classifier
5.6 Random Forest (OLS summary, Variable Selection, Optimal Model Development, Accuracy, Error elimination, Visualization)
5.7 CART Analysis (Accuracy of Model, Confusion Matrix, ROC and AUC Curve, Model Performance Criterion, GINI, Visualization)
5.8 Dimension Reduction- methodology
5.9 Principal Component Analysis

Unit 6: Unsupervised Learning & Deep Learning

6.1 Introduction
6.2 Segmentation Techniques
6.3 Clustering Techniques- Agglomerative, Hierarchical
6.4 Common Distance Measure
6.5 K-means clustering
6.6 DBSCAN
6.7 Identifying Number of Segments, Validations (K-Folds etc.)
6.8 Deep neural networks
6.9 IDP Python Toolkit: Tensor Flow - Introduction, Methods, Implementation
6.10 RNN- Introduction, Working, Implementation
6.11 CNN- Introduction, Working, Implementation

Text Books/Reference Books:

1 AurelienGeron, O'Reilly,Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, ISBN-13: 978-1492032649 ISBN-10: 1492032646.

2.Sebastian Raschka, Vahid Mirjalili, Python Machine Learning ,Third Edition, PacktPubication. ISBN: 9781789955750

3. V.K. Jain ,Machine Learning, Khanna Publishers.

4. Jeeva Jose, Introduction to Machine Learning, Khanna Publishers

Software required/Weblinks:

http://nptel.ac.in/courses/117102060/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-505**)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
BEC-DS-505.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-505.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-505.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-505.4	3	3	3	1	3	-	-	-	-	-	-	2	3	1	2	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-555: MACHINE LEARNING LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites:BEC-DS-505: Machine Learning
Course Type: Program Core

Course Outcomes

The students will be able to:

BEC-DS-555.1. Appreciate working on DAAL4Py Software.
BEC-DS-555.2. Demonstrate the effect of dataset in Python Environment.
BEC-DS-555.3. Perform Modelling using Classification.
BEC-DS-555.4. Apply codes for plotting various bar charts and design simple programs

LIST OF EXPERIMENTS:

a) Introduction to DAAL4Py installation and usage
b)Create following programs using IDP under DAAL4Py framework:
c)Introduction to IDP installation, and usage
d) Write program to import the dataset of Realtime/ offline applications. Perform various operation on dataset using Numpy and Pandas. Perform data handling operations using Pandas
e)Load the Titanic Dataset in Data Frame, View data (using Head and Tail), get data's data type, data information and perform descriptive analysis on it in python Environment (Mean, Median, Mode, std etc.). Find Skewness of data. Find any null values in the data. If yes then sum total Null values in each column. Do Null value imputation.

a) Differentiate Continuous and Categorical Data. Plot bar charts for Categorical data, Scatter plot/ line chart for Continuous data. And do pair plotting as well. Visualize the skewness, correlation- for continuous data (using Heatmap). Perform Encoding (Label/ One-Hot encoding).
b) Perform Feature Engineering/ Feature Selection. List the most important features with reason. Perform Modelling using classification. Use KNN, Decision Tree, Random Forest, SVM classifier. Find the accuracy in each classifier. And draw confusion matrix and ROC.
c) Load the House Price Prediction dataset in Data Frame with size of 1460X81. Find Null values. Perform Descriptive and Exploratory Data analysis (EDA) with Visualization.
    i) Perform all the Data Preprocessing steps. List down important features.
j) Perform Modelling- Use Ridge, Lasso, XGBoost, LGBm, Random Forest. Use stacking method. Find out the error using optimal method and R2 score.
k) Load the Credit Card Data set. Perform all the necessary steps till modelling. Perform Silhouette Analysis to find optimal number of clusters. Apply Kmeans Clustering with number of clusters got from silhouette analysis.
l) Use Iris Dataset and perform All the Machine Learning steps to get best Accuracy.
m) Perform all the required steps on Online Shopper intention Data sets- using clustering.
n) Write a program in python to predict if a loan will get approved or not.

o) Write a program in Python to predict the age of the actor.
p) Write a program in python to predict the class of the flower based on the available attributes.
q) Write a program in Python to identify the tweets which are hate tweets and which are not.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Weather Forecasting
2. Stock Market Prediction
3. Web Scrapping.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-555**)**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-555.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-555.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-555.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-555.4	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-601: EMBEDDED SYSTEMS

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation: 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-601.1. Appreciate the features and architecture of PIC microcontroller.
BEC-DS-601.2. Apply the concept of assembly language programming in PIC.
BEC-DS-601.3. Analyze the MCU hardware features and operation of PIC and explain its development tools
BEC-DS-601.4 Perform the Input & Output device interfacings with PIC microcontroller.

PART – A

Unit 1: Introduction

1.1 Microprocessors Vs Microcontrollers
1.2 Embedded Microcontroller Vs External memory Microcontroller
1.3 Processor architectures: Harvard Vs Princeton, CISC Vs RISC
1.4 PIC Microcontroller features
1.5 Features unique to the PIC Microcontroller
1.6 PIC Microcontroller Families
1.7 Software development tools: tools overview, high level language, Microchip MPLAB IDE
1.8 Hex file format

Unit 2: PIC Architecture

2.1 CPU
2.2 Hardware and File Registers
2.3 PIC Microcontroller's ALU
2.4 Data Movement
2.5 The Program Counter and Stack
2.6 Reset and Interrupts
2.7 Architecture Differences

Unit 3: PIC Instruction Set and Assembly-Language

3.1 PIC MCU Instruction types
3.2 The Mid –Range Instruction Set
3.3 Low-End PIC Microcontroller Instruction Set
3.4 Sample Template, Labels, Addresses and Flags
3.5 Subroutines with parameter passing, subtraction, comparing and negation

3.6 Bit AND and OR, 16-Bit operations, MulDiv, constant multiplication and division
3.7 Delays, patch space
3.8 Structures, Pointers and Arrays
3.9 sorting data and interrupts
3.10 Event-Driven programming

PART - B

Unit 4: Basic Operating feature and Macro Development

4.1 Power input and Decoupling
4.2 Configuration Fuses and OPTION Register
4.3 TMR0
4.4 Interrupt Operation
4.5 The Right PIC Microcontroller to learn on
4.6 PIC Microcontroller Assembly-Language Macro
4.7 The Difference between Defines and Macros

Unit 5: PIC MCU optional Hardware features

5.1 Mid-Range built-in EEPROM/Flash Access
5.2 TMR1
5.3 TMR2
5.4 Serial I/O
5.5 Parallel I/O
5.6 Parallel Slave Port (PSP)
5.7 In-Circuit Serial Programming (ICSP)

Unit 6: PIC MCU Input and Output Device Interfacing and Motor control

6.1 LEDs, Switch Bounces
6.2 Matrix Keypads
6.3 LCDs
6.4 Analog I/O
6.5 Relays and Solenoids
6.6 DC Motor
6.7 Stepper Motor
6.8 R/C Servo control
6.9 Serial port

Text Books/ Reference Books:

1. Myke Predko, 2008, Programming and Customizing the PIC Microcontroller, 3rd Edition, McGraw-Hill.
2. John B. Peatman, 2012, Design with PIC Microcontrollers, 13th Impression, Pearson Education.
3. Muhammad Ali Mazidi, 2014, PIC Microcontroller and Embedded Systems: using Assembly and C for PIC18, 1st Edition, Pearson Education.
4. Mohammad Ali Mazidi, JaniceGillispieMazidi and Rolin McKinlay, 2007, 8051 Microcontroller and Embedded Systems Using Assembly and C 2nd Edition, Pearson Education.

Software required/ Web links:

Keil µVision 4
http://nptel.ac.in/courses/117104072/
http://nptel.ac.in/syllabus/syllabus.php?subjectId=117106110

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-601)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-601.1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-601.2	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-601.3	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-601.4	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-602: MOBILE COMMUNICATION

Periods/week	Credits	Max. Marks : 200
L: 3 T: 0	3	Continuous Evaluation: 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-602.1. Apply the basic concepts of mobile computing.
BEC-DS-602.2. Discuss Mobile IP and implement the architecture of Mobilecomputing, WATM and Bluetooth and classify various designs of micro mobility.
BEC-DS-602.3. Analyze mobile transport and application layer along with the concepts of file systems and broadcast systems.
BEC-DS-602.4. Comprehend various adhoc routing network protocols and demonstrate the working of transaction models.

PART-A

Unit 1: Introduction

1.1 Introduction to mobile computing, challenges in mobile computing, coping with uncertainties
1.2 Functions and Applications of Mobile computing
1.3 Mobile computing devices, Security in Mobile computing
1.4 Architecture of Mobile computing: Three tier Architecture, Design consideration for Mobile computing

Unit 2: Mobility Management

2.1 Wireless LAN – IEEE 802.11: System Architecture
2.2 HIPERLAN: WATM generic reference model & access scenario
2.3 BLUETOOTH: Architecture & user scenario
2.4 Mobile IP: Goals and assumptions, Entities and terminologies, IP packet delivery, Agent discovery
2.5 Registration, Tunneling and encapsulation, Optimizations
2.6 Introduction to Micro-Mobility: cellular IP, HAWAII, Hierarchical mobile IPv6

Unit 3: Mobile Transport and application layers

3.1 Traditional TCP- Classical TCP improvements: Indirect TCP, Snooping TCP
3.2 WAP (1.x): Architecture, Wireless datagram protocol, Wireless transport layer security
3.3 Wireless transaction protocol: WTP class 0, WTP class 1
3.4 WTP class 2 wireless session protocol: WSP/B over WTP: Session establishment, suspension and resume and termination
3.5 WSP/B complete transaction, Wireless application Environment, Introduction to WAP 2.0

PART – B

Unit 4: Publishing and accessing data in air

4.1 File systems: Introduction to distributed file system, Consistency in distributed file system
4.2 CODA: Hoarding, Emulation, Reintegration
4.3 Overview of broadcast systems: Cyclical repetition of data, Data Audio Broadcasting
4.4 Data Video Broadcasting, DVB data broadcasting and DVB for high speed internet access

Unit 5: Ad-hoc network routing protocols

5.1 Mobile Ad-hoc networks, routing, destination sequenced distance vector
5.2 dynamic source routing, dynamic state routing
5.3 Overview of ad-hoc routing protocols: Flatad-hoc routing (proactive & reactive protocols)
5.4 Hierarchical ad-hoc routing, clusterhead gateway switch routing, geographic position assisted

Unit 6: Mobile transaction and Commerce

6.1 Introduction to e-commerce and m-commerce
6.2 Introduction to transaction and its properties (ACID)
6.3 Models for mobile transaction: Kangaroo and Joey transaction, team transaction

Text Books/Reference Books:
1. Jochen Schiller , 2003, Mobile Communications, 2nd Edition, PHI/Person Education.
2. Asoke K. Talukdar ,2010, Mobile Computing, 2nd Edition, Tata Mcgraw Hill.
3. Ivan Stojmenovic, 2002, Handbook of wireless networks & mobile Computing, 2nd Edition, Wiley.
4. Raj Pandya, 2004, Mobile and personal communication system and services , 2nd Edition, Prentice Hall of India.

Software Required/Weblinks:
MATLAB and Simulink
Network Simulation tools(NS2)
https://onlinecourses.nptel.ac.in/noc16_cs13

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-602)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-602.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-602.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-602.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-602.4	3	3	3	3	3	-	-	-	-	-	-	2	3	2	2	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-651: EMBEDDED SYSTEMS LAB

Periods/week Credits	Max. Marks : 100
P: 2 1	Continuous Evaluation: 50
Duration of Examination: 2 Hrs	End Semester Examination : 50

Co-requisites: EC-626: Embedded Systems

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-651.1. Develop program using PIC microcontroller and interface external devices with it.
BEC-DS-651.2. Develop program using Arduino UNO.
BEC-DS-651.3. Interface external devices with Arduino UNO.
BEC-DS-651.4. Illustrate the ARM microcontroller & its programming.

LIST OF EXPERIMENTS:

1. To understand the working of PIC Microcontroller Kit.
2. Write and execute a program using PIC to perform arithmetic operations.
3. Write and execute a program using PIC to perform logical operations.
4. Write and execute a program to ON and OFF the Buzzer.
5. Write and execute a program to ON and OFF the Relay.
6. Write and execute a program using for flashing LED's.
7. Write and execute a program using PIC for square wave generation using timer.
8. Write and execute a program using PIC to sound a buzzer using external interrupt.
9. Write and execute a program using PIC to control DC Motor.
10. Write and execute a program using PIC to display 'MRIU' on LCD.
11. To understand the working of Arduino UNO Board.
12. Write and execute a program to Interface Relay and Buzzer with Arduino UNO.
13. Write and execute a program to control DC motor using Arduino UNO.
14. To understand the working of ARM1768 Daughter Board.
15. Write and execute a program using LPC1768 for flashing LED's.
16. Write and execute a program using LPC1768 to display 'MRIU' on LCD.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. Control the Large appliances using Relay.
2. Flash the array of LED for every 1 second.
3. 8 Player Quiz Buzzer using Microcontroller.
4. Speed control of DC motor using PWM.
5. GLCD interfacing with Arduino UNO.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-651)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-651.1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-651.2	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-651.3	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-651.4	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-652A: SIMULATION LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-602: Communication Engineering

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-652.1. Explain the scope of various toolkits available in the simulation software of MATLAB and LABVIEW.
BEC-DS-652.2. Design analog and digital electronic circuits using MATLAB SIMULINK, LABVIEW software & NI ELVIS II
BEC-DS-652.3. Describe different modulation techniques, design of simulink models and their simulation in MATLAB environment.
BEC-DS-652.4.Design a Temperature Sensing Unit using LABVIEW software and NIELVIS II.
BEC-DS-652.5. Design a Water Level Detector Using LabVIEW software and NIELVIS II.

LIST OF EXPERIMENTS:

1. To design Half Wave Rectifier Waveform and Full Wave Rectifier Waveform Using Switch in MATLAB Simulink.
2. To design AM, DSB-SC, SSB system using MATLAB/SIMULINK.
3. To design Frequency Modulation system without built in FM box in Matlab Simulink.
4. To design Amplitude shift keying (ASK) and Frequency shift keying (FSK) system model in MATLAB/ SIMULINK.
5. To design Binary phase shift keying (BPSK) and Quadrature Phase Shift Keying (QPSK) system model in MATLAB/ SIMULINK.
6. To design pulse amplitude modulation (PAM) and Pulse-width modulation (PWM) system model in MATLAB/ SIMULINK.
7. To convert the temperature from celsius to fahrenheit using LabVIEW.
8. Design a Temperature Sensing Unit Using LabVIEW.
9. Design a Water Level Detector Using LabVIEW.
10. To simulate Ohm's Law for a circuit using LABVIEW software & NI ELVIS II.
11. To simulate and plot the V-I characteristics of diode and also verify its operation using LABVIEW software& NI ELVIS II.
12. To simulate and plot the characteristic curve of common emitter configuration of NPN transistor using LABVIEW software & NI ELVIS II.
13. To simulate and verify the operation of NPN transistor as amplifier using LABVIEW software & NI ELVIS II.

14. To simulate Kirchhoff's Voltage Law and Kirchhoff's Current Law for a circuit using LABVIEW software & NI ELVIS II.
15. To simulate and verify the operation of an RC circuit and also plot capacitor's charge and discharge curves using Lab View NI ELVIS II.
16. To simulate RLC Circuits and plot it's frequency response as well as attenuated response using LABVIEW software & NI ELVIS II.
17. To design a noise cancellation system to reduce noise in MATLAB/SIMULINK.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. To simulate and verify the operation of Analog-to-Digital Converter (ADC) usingLABVIEW software & NI ELVIS II.
2. To simulate and verify the operation of Digital-to-Analog Converter (DAC) usingLABVIEW software & NI ELVIS II.
3. To find the interpolation of a signal using MATLAB/SIMULINK.
4. To find decimation of a signal using MATLAB/SIMULINK.
5. To find Bit Error Rate of a signal using MATLAB/SIMULINK.

NOTE: Every student needs to do minimum 10 number of experiments/practicals and 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-651)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-651.1	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-651.2	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-
BEC-DS-651.3	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-651.4	3	3	2	1	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-651.5	3	3	2	1	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-614: FIBRE OPTICS

Periods/week	Credits	Max. Marks	: 200
L:3 T: 0	3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-614.1. Interpret the basic concepts of optical fiber communication along with its applications.
BEC-DS-614.2. Appreciate transmission characteristics of optical fiber.
BEC-DS-614.3. Comprehend the structure of optical fiber and summarize modulation and multiplexing techniques for optical fiber system
BEC-DS-614.4. Discuss different light sources along with their working principle and structure.
BEC-DS-614.5. Explain their working principle and structure.

PART-A

Unit 1: Introduction to Fiber Optics

1.1 Optical fiber communication system, Electromagnetic spectrum
1.2 Comparison with other transmission media, Advantages and disadvantages of optical communication
1.3 Optical fiber applications, Intensity Modulation: Direct and Sub carrier
1.4 System design considerations, Multiplexing

Unit 2: Optical Fiber

2.1 Structure of optical waveguide, Ray theory: acceptance angle, total internal reflection
2.2 Numerical aperture, skew rays
2.3 Classification of optical fiber based on: material used for manufacture, refractive index
2.4 Number of modes, Fiber Couplers, Fiber Connectors

Unit 3: Transmission characteristics of optical fiber

3.1 Attenuation, Material absorption losses
3.2 Linear and nonlinear scattering, Fiber bend losses
3.3 Dispersion: Intramodal and Intermodal

PART-B

Unit 4: LED Light Source

4.1 Characteristics of good optical source, Recombination process
4.2 Spectrum of recombination radiation, LED characteristics
4.3 Internal and external quantum efficiency
4.4 LED structures, lens coupling to fiber

Unit 5: Laser Sources

5.1 Principle of laser action: absorption and emission, Population inversion
5.2 Optical feedback and amplification
5.3 Types of lasers, Comparison with LED's

Unit 6: Optical Detectors

6.1 Requirements for photo detectors, Types of photo detectors
6.2 Characteristics of photo detectors
6.3 Principle of APD and PIN diodes
6.4 Noise in photo detectors
6.5 Photo transistors and photoconductors

Text Books/Reference Books:

1. Djafar K. Mynbaev,2009, Fiber-Optic Communications Technology ,6thEdition, Pearson Education
2. Selvarajan, Kar, Srinivas,2006, Optical Fiber Communications,5thEdition, Tata McGraw Hill
3. John M Senior, 2010,Optical Fiber Communications, 2nd Edition, Pearson Education
4. Gerd Keiser, 2008,Optical Fiber Communications: 4thEdition, Tata McGraw Hill
5. John Gowar, 1993,Optical Communications Systems,2nd Edition, Prentice Hall

Software Required/Weblinks:

OptiSystem:Optical communication system design software
nptel.ac.in/courses/117101002
nptel.ac.in/downloads/117101054
https://www.youtube.com/watch?v=oIurmHsRFSc

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation Table:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix :

CO Statement (BEC-DS-614)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-614.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-614.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-614.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-614.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-614.5	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-621: RTL DESIGN SYNTHESIS USING VERILOG

Periods/week	Credits	Max. Marks : 200
L: 3 T: 0	3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination: 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-621.1. Elaborate the importance of verification and associated methodologies.
BEC-DS-621.2. Explain the fundamentals and language constructs of System Verilog.
BEC-DS-621.3. Apply the extended features and OOP concepts used in System Verilog to different verification codes.
BEC-DS-621.4. Classify different Testbench architectures, Verification Architectures and their applications.
BEC-DS-621.5. Write Testbench for different digital designs and test their functionality.

PART A

Unit 1: Verification Environments
1.1 VLSI Design Flow and importance of Verification
1.2 Verification: Planning, Approaches, Matrices
1.3 Verification Methodologies: Simulation: Formal and Assertions
1.4 Directed vs Constrained Random Verification and Coverage
1.5 Other Trends- Hardware + Software Verification and Emulation

Unit 2: Introduction to System Verilog and Fundamentals
2.1 SV Introduction: History and Overview
2.2 Language Constructs: Data Types and Operators
2.3 Loops and Controls
2.4 Procedural Statements
2.5 Tasks and Functions
2.6 Arrays and Queues

Unit 3: SV Extended Features and OOP Concepts
3.1 Inter process Communication
3.2 Interface
3.3 Program Blocks
3.4 OOP Concepts
3.5 Classes
3.6 Randomization and Constants

PART B

Unit 4: Verification Architecture

4.1 SV Testbench Architectures
4.2 Verification Flow and Simulation Process
4.3 Types of Testbench – Architecture and Applications
4.4 Testbench Building Blocks
4.5 Verification Architecture

Unit 5: Writing a Testbench

5.1 Virtual interface
5.2 TB Top
5.3 Generator, Driver, Monitor
5.4 Scoreboard, Config and Package
5.5 Examples of simple designs testing in System Verilog

Unit 6: Functional Coverage

6.1 Functional Coverage
6.2 DPI
6.3 Signal and Transaction Level Functional Coverage
6.4 Integrating Functional Coverage into SV Testbench
6.5 Build a Constrained Random Coverage Driven testbench using SystemVerilog for a complex design

Text Books:

1. Chris Spear, "System Verilog for Verification", Second Edition, Springer.
2. Stuart Sutherland, Simon Davidmann, Peter Flake, 2004, System Verilog For Design, Kluwer Academic Publishers..

Reference Books:

1. Ashok B. Mehta, 2016, SystemVerilog Assertions and Functional Coverage: Guide to Language, Methodology and Applications, 2nd Edition, Springer.

2. Donald Thomas, Logic Design and Verification using System Verilog (Revised).

3. Andreas S. Meyer, Principles of Functional Verification, 1st Edition, Newnes Publications.

Software required/Weblinks:

XILINX ISE Design Suite
https://www.youtube.com/watch?reload=9&v=wiNDn19GpRU

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-621)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-621.1	1	3	2	3	3	1	-	-	-	-	-	1	3	3	3	3
BEC-DS-621.2	-	1	3	3	3	3	1	-	-	-	-	1	3	3	3	3
BEC-DS-621.3	-	2	3	3	3	-	-	-	-	-	-	-	3	3	3	3
BEC-DS-621.4	-	3	3	3	3	1	-	-	-	-	-	-	3	3	3	3
BEC-DS-621.5	-	3	3	3	3	1	1	-	-	-	-	1	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-403 : OPERATING SYSTEMS

Periods/week Credits	Max. Marks : 200
L :3 T: 1 4.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Term Examination : 100

Course Type: Elective

Course Outcomes: Students will be able to-

BCS-DS-403.1 define operating system, processes and thread, Inter-process communication, deadlocks, memory, I/O hardware, file and disk management.

BCS-DS-403.2 understand scheduling, deadlock prevention and avoidance concepts, Inter-process communication problems, concepts of memory management and I/O hardware device, file and disk management.

BCS-DS-403.3 apply the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

BCS-DS-403.4 analyze processes, scheduling algorithms, inter-process communication mechanism, deadlock conditions, memory, I/O hardware, file and disk management system.

BCS-DS-403.5 evaluate scheduling criterias, components and management aspects of concurrency management, file and directory implementation efficiency and performance.

BCS-DS-403.6 develop the I/O management functions in OS as part of a uniform uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

PART - A

Unit 1: Introduction

1.1 Concept of Operating Systems, generations of operating systems, types of operating systems, OS services, system calls.

1.2 Structure of an OS – Layered, monolithic, microkernel operating systems.

1.3 Concept of virtual machine.

1.4 Case study on UNIX and WINDOWS operating system.

Unit 2: Processes

2.1 Definition, process relationship, different states of a process, process state transitions, Process Control Block (PCB), context switching.

2.2 Thread: Definition, various states, benefits of threads, types of threads, concept of multithreads.

2.3 Process Scheduling: Foundation and scheduling objectives, types of schedulers.

2.4 Scheduling criteria: CPU utilization, throughput, turnaround time, waiting time, response time.

2.5 Scheduling algorithms: pre-emptive and non pre-emptive, FCFS, SJF, RR.

2.6 Multiprocessor scheduling: real time scheduling: RM and EDF.

Unit 3: Inter-process Communication

3.1 Critical section, race conditions, mutual exclusion.

3.2 Hardware solution, strict alternation, peterson's solution, the producer\ consumer problem.

3.3 Semaphores, event counters, monitors, message passing.

3.4 Classical IPC Problems: reader and writer problem, dining philosopher problem etc.

PART - B

Unit 4: Deadlocks

4.1 Definition, necessary and sufficient conditions for deadlock.
4.2 Deadlock prevention.
4.3 Deadlock avoidance: Banker's algorithm.
4.4 Deadlock detection and recovery.

Unit 5: Memory Management

5.1 Basic concept, logical and physical address map.
5.2 Memory allocation: Contiguous memory allocation, fixed and variable partition, internal and external fragmentation and compaction.
5.3 Paging: principle of operation, page allocation, Hardware support for paging, protection and sharing, disadvantages of paging.
5.4 Virtual Memory: Basics of virtual memory, hardware and control structures.
5.5 Locality of reference, page fault , working set , dirty page/dirty bit, demand paging.
5.6 Page replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not Recently Used (NRU) and Least Recently Used (LRU).

Unit 6: I/O Hardware

6.1 I/O devices, device controllers, direct memory access.
6.2 Principles of I/O Software: Goals of interrupt handlers, device drivers, device independent I/O software.
6.3 Secondary-storage structure: Disk structure, disk scheduling algorithms.
6.4 File Management: Concept of file, access methods, file types, file operation, directory structure, file system structure. Allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.
6.5 Disk Management: Disk structure, disk scheduling - FCFS, SSTF, SCAN, C-SCAN, disk reliability, disk formatting, boot-block, bad blocks.

Text Books/ Reference Books:

1. AviSilberschatz, Peter Galvin, Greg Gagne, Operating System Concepts Essentials, 9th Edition, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India.

Suggested reference books:

1. Charles Crowley Operating System: A Design-oriented Approach, 1st Edition, Irwin Publishing
2. Gary J. Nutt, Operating Systems: A Modern Perspective, 2nd Edition, Addison-Wesley.
3. Maurice Bach, Design of the Unix Operating Systems, 8th Edition, Prentice-Hall of India
4. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates

Instructions for paper setting:

Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix:

CO Statement (BCS-DS-403)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-DS-403.1	2	2	1	3	2	2	2	1	2	2	2	3	2	2	2
BCS-DS-403.2	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
BCS-DS-403.3	2	3	3	1	2	2	1	2	2	1	2	2	2	2	2
BCS-DS-403.4	2	1	2	2	2	-	1	1	2	2	1	1	1	2	1
BCS-DS-403.5	1	2	1	2	2	1	1	2	2	2	2	2	2	2	2
BCS-DS-403.6	1	2	2	2	1	2	2	1	3	1	1	3	2	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-611: MICROWAVE THEORY AND TECHNIQUES

Periods/week Credits		Max. Marks : 200
L: 3 T: 0	3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-611.1. Explain the basics of microwaves, its importance and applications.
BEC-DS-611.2 Compare various types of waveguides and determine the solution of wave equations.
BEC-DS-611.3. Apply scattering matrix for analysis of various microwave passive components.
BEC-DS-611.4. Illustrate various microwave active components, their construction and working.
BEC-DS-611.5. Describe various parameters associated with the wave and various techniques for measurement parameters and the basic concepts of RADAR.

PART- A

Unit 1: Introduction to Microwaves

1.1 Electromagnetic Spectrum
1.2 Standard band designation for Microwave Frequency
1.3 Microwave system, Advantages and Disadvantages of Microwaves
1.4 Applications of microwaves

Unit 2: Waveguides

2.1 Comparison of waveguides with two wire transmission lines
2.2 Types of waveguides, Propagation of waves in rectangular waveguides, TE, TM, TEM modes in rectangular waveguide
2.3 Propagation of TM waves in Rectangular waveguide, Propagation of TE waves in Rectangular waveguides
2.4 Degenerate and dominant modes, Wave impedance in TE and TM waves
2.5 Power transmission and power losses in rectangular waveguides
2.6 Excitation of various modes, Cylindrical Waveguides
2.7 Propagation of TM and TE waves in cylindrical waveguides
2.8 Introduction to strip line and micro strip line

Unit 3: Microwave Components

3.1 Microwave Junctions
3.2 Scattering Matrix, Microwave Tee Junctions
3.3 Hybrid ring, Directional couplers
3.4 Ferrite Devices: Isolators, Circulators, Microwave Attenuators

3.5 Phase Shifters, Frequency meter, Slotted line section, VSWR meter, Tunable detector, Matched load, Cavity Resonator
3.6 Expression for Resonant Frequency in rectangular and circular cavity resonator
3.7 Quality factor of a cavity resonator

PART- B

Unit 4: Microwave Tubes

4.1 Limitations of conventional tubes at microwave frequencies
4.2 Construction, Working, Characteristics, Operating Principles and applications of the following Devices: Two Cavity klystron Amplifier, Reflex klystron, Cavity Magnetron
4.3 Travelling Wave Tube (TWT), Crossed Field Amplifier, Backward wave oscillator (BWO)

Unit 5: Microwave Semiconductor Devices

5.1 Principle of Operation, Working, Characteristics and applications of PIN diode
5.2 Tunnel diode, GUNN diode
5.3 Varactor diode, IMPATT diode
5.4 TRAPATT diode

Unit 6: Microwave Measurements and Introduction to RADAR

6.1 Power measurement using calorimeter and bolometer
6.2 Measurement of frequency, Measurement of Wavelength
6.3 Measurement of VSWR, Measurement of Impedance
6.4 Block diagram and operation of RADAR, RADAR frequencies
6.5 Applications of RADAR
6.6 Simple form of RADAR equation

Text Books/Reference Books:

1.Samuel Y Liao , 2003, MicrowaveDevices and Circuits, 3rd Edition, Pearson Education India.
2. M.Kulkarni , 2003, Microwave and RADAR Engineering, 4th Edition, Umesh Publication.
3.Robert.E.Collins, 2007,Foundations for Microwave Engineering, 2ndEdition,WileyIndiaStudent Edition.
4. Monojit Mitra, 2000, MicrowaveEngineering,DhanpatRai,Edition 3rd Reprint Edition ,Dhanpat Rai & Company.
5. Merrill L. Skolnik , 2001, Introduction to RADAR Systems, 3rd Edition, Tata McGraw-Hill Education.

Software required/Weblinks:

MATLAB
http://nptel.ac.in/courses/117101119/1- 117101119/35
http://nptel.ac.in/courses/117105122/1- 117105122/17
http://nptel.ac.in/video.php?subjectId=117101056

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-611)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEC-DS-611.1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-611.2	3	3	2	2	3	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-611.3	3	3	2	2	3	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-611.4	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-611.5	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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HM 606: FRENCH II

Periods/week Credits	Max. Marks : 100
P:2 2	Continuous Evaluation: 50
Duration of Examination: 1.5 Hrs	End Semester Examination: 50

Course Type: Elective

Course Outcomes

HM-606.1. Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.

HM-606.2. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.

HM-606.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

HM-606.4. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

HM-606.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

PART -A

Unit 1: Se présenter (1)

1.1 Les pluriels
1.2 Adjectives to describe a person

Unit 2: Se présenter (2)

2.1 Professions
2.2 Short essay on family & friend
2.3 Comprehension

Unit 3: Parler de ses habitudes quotidiennes

3.1 Les verbespronominaux
3.2 Décrivezvotrejournée

PART -B

Unit 4: Nommez et localiser des lieux dans la ville

4.1 Prepositions
4.2 Asking & telling the way

Unit 5: Informations simples sur le climat, la météo

5.1 Les saisons
5.2 Les expressions de la saison
5.3 Comprehension

Unit 6: Demander/ indiquer les horaires et les couleurs

6.1 Timings
6.2 Colours

Text Books/Reference Books/ Suggested Readings:

1. Annie Berthet, Catherine Hugot, Veronique M Kizirian,2006, Alter Ego Level One Textbook, , Hachette Publications
2. Mahitha Ranjit, 2016, Apprenons Le Francais II & III, Saraswati Publications

Weblinks:

www.bonjourfrance.com
www.allabout.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

Evaluation Tools:
Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (HM–606)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
HM-606.1	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-606.2	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-606.3	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-606.4	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-606.5	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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HM 607: GERMAN II

Periods/week Credits	Max. Marks	: 100
P:2 2	Continuous Evaluation	: 50
Duration of Examination: 1.5 Hrs	End Semester Examination: 50	

Course Type: Elective

Course Outcomes

HM-607.1. Students will be able to discuss about various directions, countries and languages they speak.
HM-607.2. Students will be able to write short essays on family and friends. They will have knowledge of tenses.
HM-607.3. Students will be able to identify classroom vocabulary in the German language
HM-607.4. Students will be able to speak ordinal and cardinal numbers and they will also learn months, days in German
HM-607.5. They will be able to express or/and justify opinions using equivalents of different verbs.

PART -A

Unit 1: Ordinal und KardinalZahlen

1.1 Ordinal & Cardinal numbers
1.2 Months, days, Feiertage and dates

Unit 2: sein und haben

2.1 Verbs: to be and to have
2.2 helping verbs practice worksheets
2.3 Vocabulary (Family) short essay on family, friends etc.

PART-B

Unit 3: GegenständeimKursraum

3.1 Vocabulary (classroom)
3.2 Definite and indefinite articles

Unit 4: Länder, Sprachen

4.1 Countries, languages, directions
4.2 Past of the verb 'to be'

Text Books/Reference Books:

1. Rita Maria Niemann, Cornelsen, 2005, Studio d A1: Deutsch alsFremdsprache, Volume 6.

2. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch alsFremdsprache Tangram aktuell 1 - Lektion 1-4: Deutsch als. (Hueber Verlag, 2005).
3. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch alsFremdsprache Tangram aktuell 1 - Lektion 5-8: Deutsch als. (Hueber Verlag, 2005).
4. Paul Rusch, 2015: Langenscheidt and Klett

Weblinks:

http://www.nthuleen.com/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

Evaluation Tools:
Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (HM–607)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
HM-607.1	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-607.2	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-607.3	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-607.4	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-607.5	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

HM 608: SPANISH II

Periods/week Credits	Max. Marks : 100
P:2 2	Continuous Evaluation : 50
Duration of Examination: 1.5 Hrs	End Semester Examination: 50

Course Type: Elective

Course Outcomes

HM-608.1. Students will be able to know about various color names in Spanish along with various vocabularies related to cloths and wardrobe.
HM-608.2. Students will be able to differentiate between Ser and Estar verbs along with uses.
HM-608.3. Students will be able to have knowledge of adjectives along with telling time.
HM-608.4. Students will be able to count till 1000
HM-608.5. Students will be able to have knowledge of regular –ER and –IR verbs along with its various uses.

PART-A

Unit 1 :Color and Clothing

1.1 Introduction of colors
1.2 Vocabulary related to clothes and wardrobe

Unit 2 : Ser, Estar and Haber

2.1 Difference between the use of Verbo SER and ESTAR and their use with the similar adjective.
2.2 Introduction of Verbo HABER

PART-B

Unit 3 : Adjective, Counting and Time

3.1 Demonstrative adjectives
3.2 Counting till 1000
3.3 Time

Unit 4 : Verb ER and IR and Family

4.1 Introduction and Usage of –ER Verbs
4.2 Introduction and Usage of –IR Verbs
4.3 Vocabulary related to the family and marital status

Text Books/Reference Books:

1. Eric V Greenfield, 1971, Barnes and Noble
2. Nuevo Espanol sin fronteras, Jesus Sanchez Lobato and Isabel Santos Gargallo, 2005, Goyal Saab, ELE & SGEL

Weblinks:

http://studyspanish.com/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

Evaluation Tools:
Sessional tests
Term end examination scores
Participation in class activities
Home assignments
Class attendance

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Course Articulation Matrix

CO Statement (HM–608)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
HM-608.1	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-608.2	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-608.3	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-608.4	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1
HM-608.5	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	1

SEMESTER 7

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

PROJ-EC-710: SUMMER INTERNSHIP-III

Duration of Training: 4 weeks	Max. Marks : 100
Credits: 2	Continuous Evaluation : 100
Duration of Exam: 2 Hrs	

Pre-requisites:
Course Type: Internships/Seminars

Course Outcomes
After completion of this course the students will be able to

Proj-EE-710.1. actually face challenges of real field work.

Proj-EE-710.2. apply their learning skills to solve real life problem.

Proj-EE-710.3. Show the research capability.

Proj-EE-710.4. enhance their Innovative skills.

Proj-EE-710.5. develop solutions.

Proj-EE-710.6. build technology for new areas.

Every student will have to undergo Industrial Training for 4 weeks in the relevant field of Engineering in which he/she is enrolled for B.Tech programme after 4th semester. Respective Head of Department will approve the Industry/Organization for training. During this course of time he/she will be regularly monitored and evaluated. After successful completion of the training, the student will have to submit the training report, deliver a seminar about the work/project undertaken during the training and will have to appear for viva.

The evaluation of the industrial training shall be made as per following:

Continuous Evaluation during training:

1. Evaluation by the Supervisor in the Industry	:	50 marks
2. Evaluation by Faculty mentor during training visit	:	20 marks
3. Internal Seminar/Presentation	:	30 marks
Total Internal Marks	:	**100**

External Evaluation after training:

1. Project Report	:	30 marks
2. Seminar/Presentation	:	40 marks
3. Viva	:	30 marks

Total External marks		**100**

Total Credits : **02**

Course Articulation Matrix

CO Statement (PROJ-EC-710)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
PROJ-EC-710.1	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
PROJ-EC-710.2	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
PROJ-EC-710.3	3	3	2	3	3	2	2	3	3	3	3	2	3	3	3	3
PROJ-EC-710.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
PROJ-EC-710.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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GP-EC-700: General Proficiency

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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PROJ-EC-700A: PROJECT PHASE-II/ INDUSTRIAL PROJECT

Periods/week	Credits	Max. Marks : 300
P:8	5	Continuous Evaluation : 200
Duration of Examination: 2 Hrs		End Semester Examination : 100

Pre-requisites: PROJ-EC-600: Project Phase-I
Course Type: Projects

Course Outcomes

PROJ-EC-700.1. The students will be able to do extensive literature survey in their chosen field of interest for project work.
PROJ-EC-700.2. The students will be able to implement the concepts learnt in different courses of Electronics and Communication Engineering program.
PROJ-EC-700.3. The students will be able to develop practical understanding, limitations and constraints of the theory learnt.
PROJ-EC-700.4. The students will be able to manage complex electronics and interdisciplinary projects that are innovative, motivational, entrepreneurial and industry linked.
PROJ-EC-700.5. The students will be able to learn team spirit, report writing and presentation skills.

Note: Students are required to design and implement the project (Hardware/Software based) which was initiated in Project Phase-I during VI sem.

Assessment Tools:

Distribution of Marks for Internal Assessment of Final Year Project

<table>
<tr><th></th><th colspan="2">Criteria</th><th>Weightage</th><th>Marks</th><th></th></tr>
<tr><td>1</td><td colspan="2">Attendance</td><td>10%</td><td>20</td><td>Project Coordinator + Project Guide</td></tr>
<tr><td>2</td><td colspan="2">Projects Selection and Specification</td><td>10%</td><td>20</td><td rowspan="7">Project Coordinator + Project Guide +DPC</td></tr>
<tr><td>3</td><td colspan="2">Design of Project</td><td>10%</td><td>20</td></tr>
<tr><td>4</td><td colspan="2">Implementation of Project</td><td>20%</td><td>40</td></tr>
<tr><td>5</td><td colspan="2">Testing & Evaluation</td><td>10%</td><td>20</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Project Report</td><td>Organization and Clarity</td><td>10%</td><td>20</td></tr>
<tr><td>Contents</td><td>10%</td><td>20</td></tr>
<tr><td>7</td><td colspan="2">Final Presentation and Viva</td><td>20%</td><td>40</td></tr>
<tr><td></td><td colspan="2">Total</td><td>100%</td><td>200</td><td></td></tr>
</table>

Note: Marks for all criteria mentioned above from Sr. No. 2 to 7 is separately given by both Project Guide and DPC out of max. marks mentioned against each criteria. The final calculation of total internal assessment for project is done as follows:

Marks obtained by student= A + (0.6*P)+(0.4*D)

Where "A" are the Marks Given on the Basis of Attendance against serial no. 1 "P" are the marks given by Project Guide out of Total marks against serial no. 2 to 7 and "D" are the marks given by Departmental Project Committee out of Total marks against serial no. 2 to 7.

Distribution of Marks for External Evaluation of Final Year Project			
	Criteria	**Weightage**	**Marks**
1	Project Report	20%	20
2	Presentation	20%	20
3	Viva	60%	60
	Total	100%	100

Course Articulation Matrix

CO Statement (PROJ-EC-700)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
PROJ-EC-700.1	3	3	2	3	3	2	2	3	3	3	3	2	3	3	3	3
PROJ-EC-700.2	3	3	3	3	3	2	2	3	3	3	3	2	3	3	3	3
PROJ-EC-700.3	3	3	2	3	3	2	2	3	3	3	3	2	3	3	3	3
PROJ-EC-700.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
PROJ-EC-700.5	2	3	2	3	3	2	2	3	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-603: DEEP LEARNING

Periods/week Credits	Max. Marks	: 200
L :3 T: 0 3.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Semester Examination	: 100

Course Type: Core

Course Outcomes: The Students will be able-

BEC-DS-603.1: Understand the basics of Neural Networks and Deep Learning
BEC-DS-603.2: Apply Deep Learning techniques to solve various real life problems.
BEC-DS-603.3: Apprehend state-of-art techniques used in Deep Learning industry
BEC-DS-603.4: Understand the traditional computer vision and deep learning methods for computer vision and apply it to solve real life problems.

PART-A

UNIT-1: Introduction

1.1 Introduction to Deep Learning, Bayesian Learning, Decision Surfaces
1.2 Linear Classifiers, Linear Machines with Hinge Loss
1.3 Introduction to perceptron and Multi Layer Perceptron Model
1.4 Introduction to Neural Network, Feed Forward Neural Networks
1.5 Gradient descent and back propagation algorithm
1.6 Training a neural Network.

UNIT-2: CNN - Convolution Neural Network

2.1 What is CNN, Architecture
2.2 Invariance and Stability, Scattering Networks, Group formalism
2.3 Supervised learning and classification, Properties of CNN
2.4 Regression, LISTA
2.5 What is Shell Script, Write a basic Shell script

UNIT-3: Recurrent Neural Network

3.1 LSTM (Long Short Term Memory Network),
3.2 GRU, Encoders Decoder
3.3 Architectures,
3.4 Implementation of RNN& LSTM.

PART-B

UNIT-4: Deep Unsupervised Learning

a. Unsupervised Learning,
b. Deep L-layer neural network

c. Autoeccoders (Standard, denoising, contractive , etc)
d. , Variational Autoencoders,
e. Adversarial Generative Networks, Autoencoder
f. DBM

UNIT-5: Case Studies and Applications

5.1 Predicting Bike-Sharing Patterns,
5.2 Dog Breed Classifier,
5.3 Dialogue Generation with LSTMs,
5.4 Smart Reply, Generate Faces.
5.5 Transfer Learning

UNIT-6: Deep Learning Frameworks

6.1 Introduction to Deep Learning Frameworks

6.2 Tensorflow

6.3 Keras

6.4 Caffe

6.5 Comparison of different frameworks

6.6 Intel Optimized frameworks

6.7 Deep Learning frameworks and Intel OpenVINO

Text Books / Reference Books:

11. Elain Rich and Kevin Knight (2009), Artificial Intelligence, 3rdedition, Tata McGraw Hill.
12. Stuart J.Russel and Peter Norvig (2009), Artificial Intelligence-A modern approach: 3rd edition, Pearson.
13. Patrick Henry Winston (1992), Artificial Intelligence , 3rdedition, , Pearson.
14. George F Luger, (2009), Artificial Intelligence :Structures and Strategies for Complex Problem Solving , University of New Mexico,6th edition, Pearson.
15. V S Janakiraman, Parerback (2005), Foundations of Artificial Intelligence And Expert Systems : 3rd edition, Macmillan India Limited
16. Martin T. Hagan, Howard B. Demuth, Mark Hudson Beale, Orlando De Jesús, 2nd Edition Neural Network Design, eBook

Software required/Weblinks:
http://artint.info/html/ArtInt_351.html
http://www.tutorialspoint.com/artificial_intelligence/
http://www.compinfo-center.com/tpai-t.htm
Intel OpenVINO
Intel Optimized Deep Learning frameworks

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX

CO Statement (BEC-DS-603)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-603.1	2	2	1	2	2	1	1	1	2	2	2	2				
BEC-DS-603.2	2	3	2	3	3	2	2	2	2	3	2	3				
BEC-DS-603.3	3	2	2	2	2	2	1	1	3	2	3	3				
BEC-DS-603.4	3	3	2	3	3	1	1	1	3	1	2	2			1	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-653: DEEP LEARNING LAB

Periods/week	Credits	Max. Marks	: 100
P: 2	1.0	Continuous Evaluation	: 50
Duration of Examination: 2 Hrs		End Semester Examination	: 50

Co-requisites: BEC-DS-603 DEEP LEARNING

Course Type: Core

Course Outcomes:
Students will be able to:

BEC-DS-653.1: Understand the basics of Neural Networks and Deep Learning
BEC-DS-653.2: Apply Deep Learning techniques to solve various real life problems.
BEC-DS-653.3: Understand Deep Learning for visual computing through Python
BEC-DS-653.4: Understand the traditional computer vision and deep learning methods for computer vision

LIST OF EXPERIMENTS:

1. Plot various activation functions used in Deep Learning using python language.
2. Write a hard coded program for an AND Logic gate an an OR Logic gate using the perceptron model.
3. Write a learning program for an AND Logic gate an an OR Logic gate using the perceptron model.
4. Implement an XOR Logic gate using a Multi-layer perceptron model
5. Generate a random data set using sci-kit learn library and implement a classifier to classify it using a Multi-Layer Perceptron model
6. Implement basics of TensorFlow using Python
7. Implement basics of Keras using Python
8. Implement an XOR Logic gate using TensorFlow
9. Classify Fashion MNIST Dataset using TensorFlow
10. Classify Fashion MNIST Dataset using Keras
11. Classify Handwritten Digits using TensorFlow
12. Classify Handwritten Digits using Keras
13. Implement a CNN using TensorFlow and Intel optimized TensorFlow
14. Implement a CNN Using Keras and Intel optimized Keras
15. Use VGGNet model to classify objects in a photograph
16. Use VGGNet model for image classification
17. Implement an Image Classifier using Keras and Intel optimized Keras
18. Implement a RNN to auto generate text using Keras and Intel optimized Keras
19. Apply Autoencoders for Data denoising on images
20. Implement autoencoders for dimensionality reduction for compressed representation
21. Implement variational autoencoders for generative modelling.
22. Implement a Deep Boltzmann Machine (DBM) using greedy layer wise training and fine tune it.

NOTE: Every student needs to do minimum 10 number of experiments/practicals in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-653)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-653.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-653.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-653.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-653.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-701: HIGH PERFORMANCE COMPUTING

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Core

Course Outcomes
The students will be able to:

BEC-DS-701.1: Get familiar with different high-performance computing concepts like parallelism, vectorization, multithreading concepts
BEC-DS-701.2: Impart practical usage of Intel Parallel Studio suit on an algorithm written in C/C++ and python,
BEC-DS-701.3: Show how to use Intel distribution of python to eliminate code bottlenecks and enhance performance.
BEC-DS-701.4 : Enable students to identify hotspot in underlying code and find an optimum solution using Intel dedicated tools
BEC-DS-701.5: Iimpart usage of Industry-leading libraries which would efficiently do mathematical computations and multiprocessing which would in-turn give a significant performance boost.

PART-A

UNIT-1: An introduction to parallelism
1.1 Why High-Performance Computing (HPC)?, The Arrival of Parallelism
1.2 The Power Density Race, The Emergence of Multi-Core and Many-Core Computing
1.3 The Top Six Challenges, Types of Parallelism
1.4 Stored Program Computer Architecture - General purpose microprocessors,
1.5 Performance based metrics and benchmarks – Moorie's Law, Pipelining, Vector Processors
1.6 Maximize Performance estimations, Intel Architecture, Modern Code
1.7Levels of parallelism (instruction, transaction, task, thread, memory, function)
1.8Models (SIMD, MIMD, SIMT, SPDM, Dataflow models, demand -driven computation)
1.9 Architectures: N-wide superscalar architectures
1.10Multicore, multi-threaded and vectorization

UNIT-2: Parallel Programming
1.1 Processor Architecture
1.2 Interconnect, Communication, Memory Organization,
2.3 Memory hierarchy and transaction specific memory design
2.4 Thread Organization

UNIT-3: Fundamental Design Issues And Limitations in Parallel Computing

3.1 Design Issues – (Synchronization, Scheduling, Job Allocation)
3.2 Job partitioning, Dependency Analysis
3.3 Limitations – (Bandwidth Limitations, Latency Limitations, Latency Hiding or Tolerating techniques)

PART-B

UNIT-4: Vectorization and Multithreading with openMP

4.1 Vector Operations, Vectorizing of code, automatic vectorization
4.2 Stencil, SIMD enabled Functions, Strip mining, integral vectorization
4.3 Cored and Threads, Creating Threads,
4.4 Variable sharing, parallel loops, Data Races mutexes.

UNIT-5: Memory Traffic , Clusters and MPI

5.1Cheap Flops, memory hierarchy, high bandwidth memory
5.2 Memory allocation, bypassing caches, locality in space, locality in time.
5.3 Computing Clusters, message passing interface, programming with MPI,
5.4 Compiling and Running with MPI,
5.5 Peer-Peer Messaging, Collective Communication.

Unit 6: High performance computing with Intel parallel Studio XE

6.2 AN OVERVIEW OF PARALLEL STUDIO XE
6.1.1Why Parallel Studio XE**,** what is in Parallel Studio XE, Intel Parallel Studio XE
6.2Intel Parallel Advisor
6.2.1The Advisor Workflow, Surveying the Site, Annotating Code, Checking Suitability,
6.2.2Checking Correctness, Replacing Annotations
6.3Intel Parallel Composer XE

6.3.1 Intel C/C++ Optimizing Compiler, Profile-Guided Optimization, OpenMP, Intel Threading

6.3.2 Building Blocks, Intel Integrated Performance Primitives,

6.3.3 An Application Example, IPP

6.3.4Threading, Intel Parallel Debugger Extension, Intel Debugger, Intel Math Kernel Library

6.4 Tune Amplifier XE

6.4.1Hotspot Analysis, Concurrency Analysis, Locks and Waits Analysis, Disassembly Source View

6.4.2Parallel Inspector XE

6.5 Predefined Analysis Types, Errors and Warnings
6.5.1 Static Security Analysis
6.5.2 Different Approaches to Using Parallel Studio XE

Text Books/Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.

2. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hil
3. Parallel programming with Intel parallel studio by Stephen Blair-Chappell, Andrew Stokes
4. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill

Software Required/Weblinks:

- https://software.intel.com/content/www/us/en/develop/tools/parallel-studio-xe.html
- https://techdecoded.intel.io/?s=parallel+studio&submit=Search#gs.9xegqn

https://software.intel.com/content/www/us/en/develop/tools/parallel-studio-xe/documentation.html

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-701)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O 2**	**PS O 3**	**PS O 4**
BEC-DS-701.1	3	2	3	2	2	-	-	-	-	-	-	2	3	1	1	1
BEC-DS-701.2	3	2	3	2	2	-	-	-	-	-	-	2	3	2	1	1
BEC-DS-701.3	3	2	3	2	2	-	-	-	-	-	-	2	3	2	1	1
BEC-DS-701.4	3	2	3	2	2	-	-	-	-	-	-	2	3	2	1	1
BEC-DS-701.5	3	2	3	3	2	-	-	-	-	-	-	3	3	2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC DS-751: HIGH PERFORMANCE COMPUTING LAB

Periods/week Credits		Max. Marks : 100
P: 2	1.0	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Course Type: Core

Course Outcomes
The students will be able to:

BEC-DS-751.1: Perform installation and troubleshooting of intel parallel studio XE in the Linux environment
BEC-DS-751.2:Iinvoke and make use different tools of intel parallel studio XE for code optimization
BEC-DS-751.3: Identify hotspots in underlying application and find an optimum solution using Intel dedicated tools
BEC-DS-751.4: Creates faster code by boosting application performance that scales on current and future Intel® platforms with industry-leading compilers, numerical libraries, performance profilers, and code analysers.
BEC-DS-751.5: Builds code faster by Simplifying the process of creating fast, scalable, and reliable parallel code.

Lab Experiments:
1. Code example of mixing and matching parallel constructs
2. Code example of profile guided optimization
3. Build an OpenMP code with intel compiler
4. Build a code using the parallel_for algorithm to print the value of a loop variable.
5. Application to perform a matrix multiplication on two matrices, A and B, and are filled with random numbers using the MKL.
6. Analyse a serial code using Intel Parallel Amplifier XE for Hotspot Analysis.
7. Analyse a serial program and implement parallelism using Intel C++ compiler with OpenMP.
8. Tune the OpenMP program with Intel Parallel studio XE Amplifier by checking concurrency and efficiency within the OpenMP program.
9. Building the example application using auto vectorization Options
10. Run a static security analysis with Intel Inspector on the application that has security errors that could be used in an attack.
11. Example of a code to find loops and linked lists that can be made parallel using Cilk Plus, OpenMP, and TBB.
12. Detect different threading errors in a application code with Inspector XE.
13. Use the NQueens example program with Intel Advisor to demonstrate how Advisor works.
14. Example of optimizing the sudoku generator with Intel parallel Studio XE.
15. A pipelined application using TBB

Software required/Weblinks:

- https://software.intel.com/content/www/us/en/develop/tools/parallel-studio-xe.html
- https://techdecoded.intel.io/?s=parallel+studio&submit=Search#gs.9xegqn
- https://software.intel.com/content/www/us/en/develop/tools/parallel-studio-xe/documentation.html

NOTE: Every student needs to do minimum 10 number of experiments/practicals in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-751)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-751.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-751.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-751.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-751.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-751.5	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-602: MACHINE LEARNING

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes:
The student will be able to:

BCS-DS-602.1.Outline the techniques, mathematical concepts, and algorithms used in machine learning.
BCS-DS-602.2. Describe the basic concepts of statistics, artificial intelligence, information theory and probability theory relevant to machine learning.
BCS-DS-602.3. Understand Supervised learning techniques for regression and classification in machine learning
BCS-DS-602.4. Apply the appropriate machine learning technique using unsupervised techniques for pattern recognition, optimization and decision problems
BCS-DS-602.5. Design the algorithms and techniques to solve problems using Artificial Neural Networks.
BCS-DS-602.6. Analyze the complexities of various problems in different domains.

PART- A

Unit-1: **Introduction Basic Concepts**
1.1 Probability Theory
1.2 Probability densities
1.3 Types of Variables: Quantitative & Qualitative
1.4 Measures of Central Tendency
1.5 Measures of Spread: Range, Variance, Standard deviation
1.6 Population parameters and Sample Statistics
1.7 Bayesian probabilities and Bayes Theorem
1.8 Gaussian distribution

Unit-2: Machine Learning
2.1 Introduction to Machine Learning Concepts
2.2 Types of Machine Learning Algorithms
2.3 Dimensionality Reduction Techniques: (PCA -Principal components analysis)
2.4 Feature Extraction
2.5 Feature Selection

Unit-3: Supervised Learning
3.1 Introduction to supervised learning setup
3.2 Regression and Classification
3.3 Linear Regression
3.4 Logistic Regression

3.5 Naive Bayes Classifier Algorithm
3.6 Support vector machines
3.7 Ensemble methods: Bagging, Boosting
3.8 Evaluating and debugging learning algorithms

PART- B

Unit-4: Unsupervised Learning
4.1 Introduction to Unsupervised learning
4.2 Clustering techniques
4.3 Common distance measures
4.4K-means algorithm
4.5Hierarchical agglomeration
4.6 Cross Validation and Resampling Methods
4.7 Assessing the performance of an algorithm

Unit 5: **Artificial Neural Network**
5.1 Introduction to Neural Networks
5.2 Neural Network representation
5.3 Gradient Descent
5.4 Perceptron, Multilayer perceptron
5.5 Backpropagation algorithm
5.6 Feed-forward Network Networks
5.7 Network Training – Parameter optimization

Unit 6:**Deep Learning**
6.1 Inductive Learning
6.2 Graph-Based Learning
6.3 SVM (Support Vector Machine) and Kernel Methods
6.4 Generative Methods
6.5 Human Cognitive Learning

Text Books / Reference Books:

1. S. Haykin. 2008, Neural networks and learning machines. Pearson.
2. Mitchell, Tom, 1997, Machine Learning. New York, NY: McGraw-Hill, ISBN: 9780070428072
3. Rbchard o Duda, Peter E. Hart and David G. Stork, 2001 & pattern Classification, .John Wiley & Sons Inc
4. Chris Bishop, 2007, Pattern Recognition and Machine Learning, Springer-Verlag New York, ISBN: 978-0-387-31073

Software required/Weblinks:
Python, R language
www.tutorialpoint.com

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BCS-DS-602)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BCS-DS-602.1	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-	1
BCS-DS-602.2	2	-	-	-	2	-	-	-	-	-	-	-	-	1	-	1
BCS-DS-602.3	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
BCS-DS-602.4	3	3	2	-	1	-	-	-	-	-	1	1	-	2	-	2
BCS-DS-602.5	2	-	2	1	1	-	-	-	-	1	-	-	-	3	-	2
BCS-DS-602.6	2	2	-	2	-	1	-	-	-	-	-	1	-	3	-	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-715: SATELLITE COMMUNICATION

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-715.1. Discuss the basic concepts of satellite communication along with its future trends.
BEC-DS-715.2. Define and analyze various orbital parameters.
BEC-DS-715.3. Comprehend analog and digital satellite links.
BEC-DS-715.4. Distinguish between different types of modulation and multiplexing techniques used for analog and digital satellite communication.

PART-A

Unit 1: Introduction

1.1 Origin of satellite communications, Historical background
1.2 Basic concepts of satellite communications, Frequency allocations for satellite services
1.3 Applications, Future trends of satellite communications
1.4 Active and passive satellites, Brief introduction to satellite subsystems

Unit 2: Orbital Mechanics and Launchers

2.1 Orbital mechanics, Look angle determination
2.2 Orbital perturbations, Orbit determination
2.3 Launch vehicles, Orbital effects in communication systems performance
2.4 Satellite eclipse

Unit 3: Satellite Link Design

3.1 Basic transmission theory, System noise temperature and G/T ratio
3.2 Design of down links, up link design, Complete link design
3.3 Design of satellite links for specified C/N
3.4 System design Example

PART-B

Unit 4: Analog and Digital Satellite Communication

4.1 Baseband analog signal, FDM technique
4.2 S/N and C/N ratio in FM in Satellite link, S/N ratio in FM with multiplexed telephone signal

4.3 Single channel per carrier system, Companded single sideband system, Elements of digital satellite communication systems, Digital baseband signal
4.4 Digital modulation techniques
4.5 Satellite digital link design, TDM

Unit 5: Multiple Access

5.1 Frequency division multiple access (FDMA), Intermodulation
5.2 Time division multiple access (TDMA), Frame structure
5.3 Satellite switched TDMA onboard processing
5.4 DAMA, Code division multiple access (CDMA)

Unit 6: Special satellite services

6.1 Brief introduction to: VSAT, GPS, SARSAT
6.2 MSAT, INMARSAT, DBS, Earth sensing satellite
6.3 Earth exploration satellite, Laser satellite communication

Text Books/ Reference Books:

1. D.C Agarwal, 2008, Satellite Communications, 6th Edition, Khanna Publications.
2. Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2003, Satellite Communications, 2nd Edition, Wiley Publications.
3. Dennis Roddy, 1996, Satellite Communications, 2nd Edition, McGraw Hill.
4. K.N. Raja Rao, 2004, Fundamentals of Satellite Communications, 2nd Edition, PHI.
5. Anil K. Maini, Varsha Agarwal, 2011,Satellite Technology: Principles and Applications:, 2nd Edition, Wiley Publications.
6. Tri T Ha , 1990, Digital Satellite Communication, 2nd Edition, Mc Graw Hill.

Software Required/Weblinks:
MATLAB
http://nptel.ac.in/courses/117105131/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

COStatement (BEC-DS-715)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-715.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-715.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-715.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-715.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-718: ADVANCED COMMUNICATION LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation : 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-718.1. Comprehend and implement optical analog and digital link.

BEC-DS-718.2. Appreciate different types of losses in optical communication.

BEC-DS-718.3. Create a satellite communication link in active and passive mode.

BEC-DS-719.4. Apply the concept of digital and analog baseband signal parameters and measure the radiation pattern of different antennas

LIST OF EXPERIMENTS:

1. To determine the numerical aperture of optical fiber.
2. To determine the LED radiation pattern.
3. To set up a fiber optical analog and digital link.
4. To set up a fiber optic voice link
5. To understand the propagation loss & bending loss in optical fiber.
6. To set up an active and passive satellite comm. link and study their difference.
7. To measure the baseband analog (voice) signals parameters in the satellite link.
8. To measure C/N and S/N ratio of satellite link.
9. To transmit and receive the function generator waveforms through a satellite communication link.
10. To study the effect of polarized antennas on satellite communication link.
11. To measure the variation of field strength /inverse square law of Antenna.
12. To prove the reciprocity theorem of antenna.
13. To plot Radiation pattern of WIRED Antenna, Omni-directional antenna.
14. To plot the radiation pattern of Yagi-Uda antenna array and measure radiation characteristics.
15. To plot the radiation pattern of patch antenna.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. To measure the directivity and gain of antennas: standard dipole, microstrip patch antenna and Yagi antenna.
2. To determine the coupling and isolation characteristics of a stripline (microstrip) directional coupler.
3. To plot the radiation pattern of microstrip patch antenna and measure its directivity and gain.
4. To set up PC to PC communication link using RS-232 port.
5. To set up PC to PC communication link using optical fiber and RS-232 port.
6. Modulation and demodulation light source by direct amplitude modulation technique.

NOTE: Every student needs to do minimum 10 number of experiments/practicalsand 1 project in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-718)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-718.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-718.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-718.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-718.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-721: DIGITAL CMOS VLSI DESIGN

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation: 100
Duration of Examination: 3 Hrs	End Semester Examination: 100

Course Type: Program Core

Course Outcomes

The students will be able to
BEC-DS-721.1: Demonstrate advanced knowledge in the MOS Design Static and dynamic characteristics of CMOS to design and to develop the Digital Integrated Circuits for different Applications
BEC-DS-721.2: Analyze complex engineering problems critically in the domain of CMOS Digital Integrated Circuits for conducting research
BEC-DS-721.3 Solve engineering problems for feasible and optimal solutions in the core area of CMOS Digital ICs
BEC-DS-721.4 Apply the CMOS Digital IC concepts for usage of modern CAD tools and their Limitations

PART-A

Unit 1 : MOS Design History and overview.

1.1 Integrated Circuit (IC) technology developments.
1.2 Pseudo NMOS Logic – Inverter, Inverter threshold voltage
1.3 Rise time, Fall time, Pseudo NMOS logic gates
1.4 Transistor equivalency, CMOS Inverter logic.

Unit 2 : Combinational MOS Logic Circuits:

2.1 MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate,
2.2 Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates
2.3 AOI and OIA gates, CMOS full adder
2.4 CMOS transmission gates, Designing withTransmission gates.

Unit 3: Sequential MOS Logic Circuits

3.1 Behaviour of bistable elements, SR Latch,

3.2 Clocked latch and flip flop circuits, 3.3 CMOS D latch and edge triggered flip-flop

PART-B

Unit 4: Dynamic Logic Circuits

4.1 Basic principle, Voltage Bootstrapping
4.2 Synchronous dynamic pass transistor circuits
4.3 Dynamic CMOS transmission gate logic
4.4 High performance Dynamic CMOS circuits

Unit 5: Semiconductor Memories Types

5.1 RAM array organization
5.2 DRAM – Types, Operation,
5.3 Leakage currents in DRAM cell and refresh operation,
5.4 SRAM operation Leakage currents in SRAM cells,
5.5 Flash Memory NOR flash and NAND flash.

Unit 6 : Design Methodology and Tools

6.1 Introduction
6.2 Structured Design Strategies
6.3 Design Methods, Design Flows
6.4 Design Economics, Data Sheets and Documentation.

Text Books/ Reference Books:

1. Ken Martin , 2011, Digital Integrated Circuit Design –, Oxford University Press
2. Sung-Mo Kang, YusufLeblebici , 2011, CMOS Digital Integrated Circuits Analysis and Design –, TMH, 3rd Ed.
3. 3/E Weste, Weste Neil H.E. , CMOS VLSI Design: A Circuits And Systems Perspective, Pearson Education India.
4. Ming-BO Lin, 2011, Introduction to VLSI Systems: A Logic, Circuit and System Perspective ,CRC Press
5. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits – A Design Perspective, 2nd Ed., PHI.
6. Eugene D Fabricus, 1990, Introduction to VLSI Design, McGraw Hill International Edition.

Software required/Weblinks:

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-721)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-721.1	1	1	1	1	2	-	-	-	-	-	-	2	1	2	-	-
BEC-DS-721.2	1	1	2	1	3	-	-	-	-	-	-	2	2	3	-	-
BEC-DS-721.3	1	2	3	3	3	-	-	-	-	-	-	3	2	3	-	-
BEC-DS-721.4	2	2	3	3	3	-	-	-	-	-	-	3	2	3	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-713: ROBOTICS

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-713.1. Apply the fundamental aspects of Robotics.
BEC-DS-713.2. Comprehend various methodologies to be taken into account for the design and development of robotic systems and explain the contextual architecture of robotics.
BEC-DS-713.3. Implement a program using ATMEGA 328 and Arduino for Robotics.
BEC-DS-713.4 Explore the real world applications by developing the interface of various systems with microcontrollers.

PART-A

Unit 1: Basic Concepts in Robotics

1.1 Introduction to Robotics
1.2 Classification of Robots
1.3 Types of Robots
1.4 Robot Applications and Advantages
1.5 Anatomy of a Robot
1.6 Numerical control of machine tools
1.7 Resolution, Accuracy and Repeatability
1.8 Position Representation

Unit 2: Robot Kinematics & Drives

2.1 Direct Kinematics problem in Robotics
2.2 Geometry-Based Direct Kinematic Analysis
2.3 Coordinate and vector transformation using matrices
2.4 D-H representation
2.5 Application of DH method
2.6 Robot Drive System
2.7 Hydraulic Drive, Electric Drive & Pneumatic Drive System

Unit 3: Robot Manipulators, Transmission System & End Effectors

3.1 Construction of Manipulators
3.2 Manipulator Dynamic & Force Control
3.3 Electronic and Pneumatic Manipulators

3.4 Introduction to Robot Mechanical Transmission System
3.5 Robot End Effectors and its Classifications
3.6 Gripper Design and Analysis

PART - B

Unit 4: Introduction to Microcontroller and Arduino

4.1 Introduction to Microcontroller
4.2 ATMEGA328 Architecture
4.3 ATMEGA328 Pin Diagram & Internal Registers
4.4 Introduction to Arduino
4.5 Arduino architecture
4.6 Base Structure of Arduino Programming
4.7 Arduino standard libraries and contributed libraries

Unit 5: Programming in Arduino Environment

5.1 Introduction to Embedded C
5.2 Variables, Functions, Analog Pins
5.3 Logical & Math Operations
5.4 Control Statements
5.5 Loops
5.6 Operation with digital and analog pins
5.7 Communication (Serial, SPI, I2C)

Unit 6: Real World Interfacing Applications

6.1 Introduction to Robotic Sensor
6.2 Arduino Interfacing with Bluetooth
6.3 Arduino Interfacing with Motor: DC motor, Stepper motor, Servo motor
6.4 Case study of Robotic Arm
6.5 Case study of Hexapod Robot
6.6 Artificial Intelligence in Robotics

Text Books/ Reference Books:

1. Yoram Koren, 1985, Robotics for Engineers, 1st Edition, McGraw Hill Book Company.
2. John J. Craig, 2004, Introduction to Robotics, 3rd Edition, Pearson.
3. Simon Monk, 2012, Programming Arduino Getting Started with Sketches, 1st Edition, Tab Electronics.
4. John Nussey , 2013, Arduino For Dummies, 1st Edition, John Wiley & Sons.

Software required/Weblinks:

Keil, FlashMagic
http://nptel.ac.in/video.php?subjectId=112101099
http://freevideolectures.com/Course/2373/Robotics

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-713)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-713.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-713.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-713.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-713.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-717: ROBOTICS LAB

Periods/week	Credits	Max. Marks : 100
P:2	1	Continuous Evaluation: 50
Duration of Examination: 2 Hrs		End Semester Examination : 50

Co-requisites: BEC-DS-713: Robotics
Course Type: Elective

Course Outcomes
The students will be able to
BEC-DS-717.1. Implement designs using developmental tools for Arduino and Embedded C Language.
BEC-DS-717.2.Classify different sensors used in Robotics, working principle and motors to be interfaced for meeting certain applications.
BEC-DS-717.3. Develop programs to design wireless control mechanism of Robot.
BEC-DS-717.4. Implement Robotic Arm control.

List of Experiments:

1. To understand the developmental tools for Arduino programming and Robotics Development Kit.
2. Write a program to control DC motor using L293D and Arduino.
3. Write a program to control Servo Motor movement using Arduino.
4. Implement Line Follower Robot using Robotics Development Kit.
5. Implement the motion control mechanism of Robot using Computer.
6. Write a program to control the movement of Robotic Arm.
7. Write a program to control Robot motion using Joystick**.**
8. Write a program to design a Grid Solver Robot.
9. Design a Gesture Controlled Robot using Accelerometer.
10. Write a program to control the Robot motion using Bluetooth.

PROJECTS BASED ON ABOVE EXPERIMENTS:

1. To implement a fire extinguishing robot using infrared (IR) photodiodes.
2. To write a program to control Robotic arms used for welding or handling hazardous materials.
3. To implement a soccer robot that can move forward, reverse, forward-left, forward-right, reverse-left and reverse-right.
4. To implement a line-following robots with pick-and-placement capabilities.
5. To implement a wireless robocar using arduino board.

Software required/Weblinks:

Keil, FlashMagic
http://nptel.ac.in/video.php?subjectId=112101099
http://freevideolectures.com/Course/2373/Robotics

NOTE: Every student needs to do minimum 10 number of experiments/practicals in a semester. 20% new experiments should be added every year.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

Course Articulation Matrix

CO Statement (BEC-DS-717)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-717.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-717.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-717.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-717.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-712: RADAR & NAVIGATION

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-712.1. Analyze basics of RADAR and its applications.
BEC-DS-712.2. Apply the concept of Doppler Frequency Shift for analysis of CW RADAR.
BEC-DS-712.3. Discuss the construction and working of MTI RADAR, Pulse Doppler RADAR and various tracking techniques used in RADAR.
BEC-DS-712.4. Explain RADAR receivers, duplexers, Synthetic aperture RADAR and SONAR.
BEC-DS-712.5. Estimate the performance of different Radars.

PART- A

Unit 1: Introduction to RADAR

1.1 Basic RADAR, RADAR Block Diagram and operation
1.2 RADAR frequencies, Application of RADAR

Unit 2: RADAR Equation

2.1 Simple form of RADAR Equation, Prediction of Range performance
2.2 Minimum detectable signal
2.3 Receiver noise, Signal to Noise ratio, Transmitter Power
2.4 Pulse repetition frequency & range ambiguities
2.5 System losses Propagation effects

Unit 3: CW & Frequency Modulated RADAR

3.1 The Doppler effect, CW RADAR
3.2 Frequency-modulated CW RADAR
3.3 Multiple Frequency CW RADAR

PART- B

Unit 4: MTI & Pulse Doppler RADAR

4.1 Introduction, Delay Line Cancellers
4.2 Multiple or staggered Pulse repetition frequencies
4.3 Range-Gated Doppler Filters, Digital Signal Processing
4.4 Other MTI delay line, Limitation of MTI performance, Non coherent MTI
4.5 Pulse Doppler RADAR, MTI from a moving platform

Unit 5: Tracking RADAR
5.1 Tracking with RADAR, Sequential Lobbing
5.2 Conical Scan, Monopulse tracking RADAR
5.3 Tracking in range

Unit 6: Receivers, Displays and Duplexer
6.1 RADAR Receivers, Noise Figure
6.2 Mixer, Low-noise Front ends, Displays
6.3 Duplexers, Receiver protectors
6.4 Introduction to Sonar
6.4 Synthetic Aperture RADAR (SAR)

Text Books/Reference Books:
1. Merrill L. Skolnik, 2003, Introduction to RADAR Systems, 2nd Edition, TMH.
2. Kennedy , 2012, Electronic Communication Systems, 2nd Edition, TMH.

Software required/Weblinks:
ATLAB
https://www.youtube.com/watch?v=QZ-hAvu2kog
nptel.ac.in/courses/101108056/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-712)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-712.1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	2	-
BEC-DS-712.2	1	3	2	2	2	1	-	-	-	-	1	2	1	1	2	-
BEC-DS-712.3	1	3	2	2	2	1	-	-	-	-	-	2	3	1	-	-
BEC-DS-712.4	3	3	2	2	2	-	-	-	-	-	-	2	3	1	-	-
BEC-DS-712.5	3	3	2	2	2	-	-	-	-	-	-	2	3	1	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-702: AI & IoT FOR PRACTITIONERS USING NVIDIA JETSON NANO BOARD

Periods/week	Credits	Max. Marks	: 200
L: 3 T: 0	3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Pre-requisites: Internet of Things and Artificial Intelligence with Tensorflow / Keras in Python

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-702.1: Set up NVIDIA Jetson Nano device.

BEC-DS-702.2: Build applications like image classification, object detection, image segmentation, and speech processing.

BEC-DS-702.3: Implement machine learning computations on the Nvidia Jetson Nano on the real-world datasets.

BEC-DS-702.4: Design and implement IoT systems using NVIDIA Jetson Nano board.

BEC-DS-702.5: Use OpenCV to perform a variety of operations on images and videos.

PART-A

UNIT 1: Internet of Things: An Overview

1.1. Introduction to IoT and its architecture, IoT applications, security, challenges.
1.2. Basics of Various communication protocols: TCP, UDP, MQTT.
1.3. Sensors, actuators and other output devices.
1.4. IoT services offered by cloud platforms: Azure, AWS, Google Cloud.

UNIT 2: Getting started with the NVIDIA Jetson Nano board

2.1. Install and configure Linux on the Jetson Nano, Administer the operating system remotely, install Visual studio and Jupyter Notebook.

2.2. Overview of Linux basics and terminal commands.
2.3. Implementing python programs to perform basic input – output operations using Jetson Nano GPIO pins.

2.4. Interfacing push buttons and LEDs with the Jetson Nano.

UNIT 3: Applications of IoT using NVIDIA Jetson Nano board

3.1. Interfacing various output devices and actuators with Jetson Nano board.
3.2. Communicate with sensors via GPIO port and I2C bus.
3.3. Interfacing with the Thingspeak Cloud platform.
3.4. Using git and github with the Jetson Nano board.
3.5. Performing CRUD operations in the local server.
3.6. Application of the NVIDIA Jetson Nano in healthcare, defence, automation, manufacturing, etc.

PART-B

UNIT 4: Artificial Intelligence: An Overview

4.1. Introduction to AI.
4.2. Basics of ML, its types, applications and challenges.
4.3. Supervised, unsupervised and reinforcement learning.
4.4. Overview to DL and NLP.
4.5. Introduction to ANNs: DNN, CNN and RNN.

UNIT 5: OpenCV based applications on Jetson Nano

5.1. Introduction to OpenCV, Overview of commonly used OpenCV functions.
5.2. Setting up the camera, Jetson Nano Power Mode Configuration, Installing OpenCV.
5.3. Capture image and video with a USB/CSI camera in Jetson Nano using Python and OpenCV.
5.4. Performing basic operations on the image and videos using OpenCV.
5.5. Notion of pipeline with Gstreamer, Using GStreamer from the command line.

UNIT 6: Applications of Artificial intelligence using NVIDIA Jetson Nano board

6.1. Install and use libraries specialized in AI and deep learning such as Keras, Tensorflow, Numpy and Pandas on the Jetson Nano.
6.2. Understanding Convolutional Networks.
6.3. Data Preparation, Model Building, Model training, Predictions and error analysis.
6.4. ResNet-18 model, Image regression: Application to Pattern tracking on video.
6.5. Optimizing models with TensorRT.

Recommended Books:

1. IoT Projects with NVIDIA Jetson Nano: AI-Enabled Internet of Things Projects for Beginners by Agus Kurniawan; Apress; 1st ed. edition (11 December 2020); ISBN-13 : 978-1484264515.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition by Aurélien Géron; O'Reilly Media, Inc. (September 2019); ISBN: 9781492032649.
3. Deep Learning by Josh Patterson, Adam Gibson; O'Reilly Media, Inc. (August 2017); ISBN: 9781491914250.

Useful Links:

1. https://courses.nvidia.com/courses/
2. https://developer.nvidia.com/embedded/learn/jetson-ai-certification-programs
3. https://developer.nvidia.com/embedded/learn/jetson-ai-education

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-702)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-702.1	3	3	3	3	3	2	2	1	3	3	3	3	3	3	3	2
BEC-DS-702.2	3	3	3	3	3	2	2	1	3	2	3	3	3	3	3	2
BEC-DS-702.3	3	3	2	3	3	3	2	1	3	1	2	3	3	3	2	2
BEC-DS-702.4	3	3	2	3	3	3	2	1	3	1	2	3	3	3	2	2
BEC-DS-702.5	3	3	3	3	3	3	3	1	3	3	2	3	3	3	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-752: AI & IoT LAB FOR PRACTITIONERS USING NVIDIA JETSON NANO BOARD

Periods/week	Credits	Max. Marks : 200
L: 3 T: 0	3	Continuous Evaluation: 100
Duration of Examination: 3 Hrs		End Semester Examination : 100

Pre-requisites: Internet of Things and Artificial Intelligence with Tensorflow / Keras in Python

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-752.1: Use the sensors and output devices using the GPIO pins of the Jetson Nano board.
BEC-DS-752.2: Communicate with the cloud platform using APIs to build an IoT system.
BEC-DS-752.3: Design and implement IoT systems using NVIDIA Jetson Nano board.
BEC-DS-752.4: Use OpenCV to perform a variety of operations on images and videos.
BEC-DS-752.5: Use a variety of algorithms like YOLO, ResNet.

LIST OF EXPERIMENTS:

1. Write a program to interface an LED using the push button that is connected to GPIO pin of the Jetson Nano board.
2. Write a program to interface a DC motor and generate PWM signal on Jetson nano board to control the speed of the motor.
3. Interfacing with the BME280 sensor module using Jetson Nano board to retrieve the temperature, humidity, pressure and altitude data and print it on the terminal.
4. Interfacing with the Thingspeak cloud platform using the Jetson Nano board and sending the BME280 sensor data values to it in the real-time.
5. Interfacing a robot remotely over the internet using the desired protocol.
6. To capture the images and videos using a USB and CSI camera using the OpenCV library and perform basic image operations in Python.
7. Performing facial detection using the Jetson Nano board and analysis of feelings.
8. Training the ResNet18 model and perform the object detection and recognition tasks.
9. Implementing the YOLO algorithm to create a real-time video streaming application.
10. Coding image regression models embedded in the Jetson nano kit: Applications to object tracking in a video.

Recommended Books:

1. IoT Projects with NVIDIA Jetson Nano: AI-Enabled Internet of Things Projects for Beginners by Agus Kurniawan; Apress; 1st ed. edition (11 December 2020); ISBN-13 : 978-1484264515.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition by Aurélien Géron; O'Reilly Media, Inc. (September 2019); ISBN: 9781492032649.
3. Deep Learning by Josh Patterson, Adam Gibson; O'Reilly Media, Inc. (August 2017); ISBN: 9781491914250.

Useful Links:

1. https://courses.nvidia.com/courses/
2. https://developer.nvidia.com/embedded/learn/jetson-ai-certification-programs
3. https://developer.nvidia.com/embedded/learn/jetson-ai-education

Note: At least 5 programs are to be given by the teacher concern.

Distribution of Continuous Evaluation:

Viva- I	30%
Viva- II	30%
File/Records	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:

Experiments in lab

File work/Class Performance

Viva (Question and answers in lab)

End Term Practical Exam

COURSE ARTICULATION MATRIX

CO Statement (BEC-DS-752)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-752.1	2	2	2	1	1	-	-	-	1	-	1	-				
BES-DS-752.2	1	1	1	1	-	-	-	-	-	-	-	-				
BES-DS-752.3	1	1	2	1	-	-	-	-	-	-	-	-				
BEC-DS-752.4	1	1	1	1	-	-	-	-	-	-	-	-			1	
BEC-DS-752.5	1	1	1	1	-	-	-	-	1	-	-	-			2	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-518: SOFT COMPUTING TECHNIQUES

Periods/week	Credits	Max. Marks	: 200
L: 3+2* T: 0	3	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Course Type: Elective

Course Outcomes

The students will be able to:

BEC-DS-518.1. Understand the Importance of Soft Computing.
BEC-DS-518.2. Familiarize with the basic concepts of neural networks.
BEC-DS.518.3. Understand architecture and learning algorithms of neural networks.
BEC-DS-518.4. Implement the concepts of Fuzzy logic control.
BEC-DS-518.5. Familiarize with basic concept of Genetic Algorithm and its implementation.

PART-A

Unit 1: Introduction to Soft Computing

1.1 Introduction: Introduction to soft computing, Concept of Soft Computing
1.2 Soft computing vs. Hard computing, Importance of Soft Computing
1.3 Soft Computing constituents, Methods in Soft Computing

Unit 2: Introduction to Neural Networks

2.1 Neural Networks I (Introduction & Architecture): Basic concept, biological neural network
2.2 Artificial neural network, architecture: Single layer and multilayer feed forward
2.3 Recurrent network, characteristics, learning methods
2.4 Rosenblatt's Perceptron, ADALINE , MADALINE

Unit 3: Back propagation Networks

3.1 Neural Networks II (Back propagation networks) Architecture: perceptron model, solution
3.2 Single layer artificial neural network, multilayer perception model
3.3 Back propagation learning, effect of learning rule coefficient
3.4 Back propagation algorithm

PART B

Unit 4: Introduction to Fuzzy Logics

4.1 Fuzzy Logic I (Introduction): Basic concepts of fuzzy logic
4.2 Crisp sets: operation, properties, functional mapping, relation

4.3 Fuzzy sets: operation, properties, relation
4.4 Membership function: feature, fuzzification, methods of membership value assignments

Unit 5: Defuzzification

5.1 Fuzzy LogicII (Defuzzification, Rules):defuzzification methods
5.2 Fuzzy propositios, formation of rules, compound rules, fuzzy reasoning
5.3 Fuzzy inference system (FIS): construction, working and methods
5.4 Fuzzy logic control system: architecture, operation, application

Unit 6: Soft computing techniques

6.1 Genetic Algorithm: Biological background, traditional optimization and search techniques
6.2 General GA, Operators: encoding, selection, recombination, mutation
6.3 Problem solving using GA
6.4 Classification: messy GA, adaptive GA, hybrid GA; application

Text Books/ Reference Books:

1. S.N. Sivanandam and S.N. Deepa , 2008, Principles of Soft Computing:, 2nd Edition, Wiley India.
2. J. Yen and R. Langari , 2007, Fuzzy Logic, Intelligence, Control and Information:, 2nd Impression, Pearson
Education.
3. Siman Haykin ,1998, Neural Networks: A Comprehensive Foundation :, 2nd Edition, Prentice Hall.
4. David E. Goldberg , 2006, Genetic algorithms in search, optimization, and machine learning:, 4th Impression, Pearson Education India.

Software required/Weblinks:

MATLAB
http://nptel.ac.in/courses/106106046/41
http://nptel.ac.in/courses/117105084/
http://nptel.ac.in/courses/108104049/27
http://nptel.ac.in/courses/112106064/38
http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/lecture-videos/lecture-13-learning-genetic-algorithms/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part.
Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-518)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-518.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-518.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-518.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-518.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-518.5	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BEC-DS-516: IoT ANALYTICS & SECURITY

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-516.1. Integrate the technology and standards relating to IoT analytics.
BEC-DS-516.2. Examine the critical parts of the security system required tomainstream IoT.
BEC-DS-516.3. Identify the software platforms used for integrating the sensor's data.
BEC-DS-516.4. Analyze the data using IoT analytics development tools and design a secured IoT product.

PART-A

Unit 1: Introducing IoT Analytics

1.1 Introduction
1.2 IoT Data and BigData
1.3 Challenges of IoT Analytics Applications
1.4 IoT Analytics Lifecycle and Techniques

Unit 2: IoT, Cloud and BigData Integration for IoT Analytics

2.1 Cloud-based IoTPlatform:IaaS, PaaS and SaaS Paradigms, Requirements of IoT BigData Analytics Platform, Functional Architecture
2.2 Data Analytics for the IoT:Characteristics of IoT Generated Data, Data Analytic Techniques and Technologies
2.3 Data Collection Using Low-power, Long-range Radios: Architecture and Deployment, Low-cost LoRa Implementation
2.4 WAZIUP Software Platform :Main Challenges, PaaS for IoT, Architecture, Deployment

Unit 3: Development Tools for IoT Analytics Applications

3.1 Introduction
3.2 The VITALArchitecture for IoT Analytics Applications 3.3 VITAL Development Environment
3.4 VITAL Nodes :PPI nodes, System nodes, Services nodes, Sensors nodes ,Observations ,DMS nodes , Query systems , Discover sensors nodes, Filtering nodes ,Threshold nodes ,Resample nodes

PART-B

Unit 4: IoT Analytics: From Data Collection to Deployment and Operationalization

4.1 Operationalizing Data Analytics Using the VITAL Platform
4.2 IoT Data Analysis
4.3 IoT Data Deployment and Reuse
4.4 Knowledge Extraction and IoT Analytics

Unit 5: Security Architecture in IoT

5.1 Introduction: Overview, Security Requirements
5.2 Security requirement in IoT architecture
5.3 Security in Enabling Technologies
5.4 Security concern in IoT applications

Unit 6: Security and Vulnerability in the IoT

6.1 Secrecy and Secret Key capacity
6.2 Authentication/Authorization for Smart Devices
6.3 Transport Encryption
6.4 Secure Cloud/Web Interface
6.5 Physical layer security

Text Books/ Reference Books:

1. John Soldatos,Building Blocks for IoT Analytics,Internet-of-Things Analytics ,River Publishers.
2. J. Soldatos, et al., 2015, "IoT analytics: Collect, Process, Analyze, and Present Massive Amounts of Operational data – Research and Innovation Challenges" Chapter 7 in Book, "Building the Hyperconnected Society – IoT Research and InnovationValue Chains, Ecosystems and Markets", IERC Cluster Book , River Publishers.
3.Shancang Li Da Xu, 2017, Securing the Internet of Things, 1st Edition,Syngress (Elsevier).
4. RajkumarBuyya, Amir VahidDastjerdi,Internet of Things: Principles and Paradigms ,Elsevier.

Software required / Web links:

https://www.mongodb.com
http://couchdb.apache.org

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Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-516)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-516.1	3	3	3	3	3	2	2	1	3	3	3	3	3	3	3	2
BEC-DS-516.2	3	3	3	3	2	2	2	2	3	2	3	3	3	3	3	2
BEC-DS-516.3	3	3	2	3	3	2	2	1	3	2	2	3	3	3	2	2
BEC-DS-516.4	3	3	2	3	3	2	2	1	3	2	2	3	3	3	2	1

SEMESTER 8

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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PROJ-EC-800: INTERNSHIP-III

Duration of Training: 24 weeks	Max. Marks	: 300
Credits: 10	Continuous Evaluation	: 200
	End Semester Examination	: 100

Pre-requisites:
Course Type: Internships/Seminars

Course Outcomes
The students will be able to:
PROJ-EC-800.1 Analyze the real working environment and get acquainted with the organizational structure, business operations and administrative functions.
PROJ-EC-800.2. Apply the subject knowledge to their related fields so that they can relate and reinforce what has been taught at the university.
PROJ-EC-800.3. Develop synergetic collaboration between industry and the university.
PROJ-EC-800.4. Exercise the role of the professional/specialist/manager/supervisor confidently in the relevant industry.
PROJ-EC-800.5. Explore options in their career plans and make a gradualtransition from academia to career.

Every student will have to undergo Industrial Training for 24 weeks in the relevant field of Engineering in which he/she is enrolled for B.Tech programme after 7thsemester. Respective Head of Department will approve the Industry/Organization for training. During this course of time he/she will be regularly monitored and evaluated. The evaluation of the industrial training shall be made as following:

Assessment Tools:

Continuous Evaluation during training:

1. Evaluation by the Supervisor in the Industry	:	75 marks
2. Evaluation by Faculty mentor during training visit	:	50 marks
3. Internal Seminar/Presentation	:	75 marks
Total Internal Marks	:	**200**

External Evaluation after training:

1. Project Report	:	30 marks
2. Seminar/Presentation	:	20 marks
3. Viva	:	50 marks

Total External marks		**100**

Total Credits	**:**	**14**

The parameters for evaluation during the training for Supervisor shall be as under:

		Marks
g)	Work/Project undertaken	15
h)	Punctuality/ Regularity	10
i)	Discipline/ Overall Conduct/ Relations with Seniors and others	10
j)	Eagerness to acquire Technical Knowledge	20
k)	Overall Proficiency achieved during Training	10
l)	Any contribution to the organization	10

	Total	75

The parameters for evaluation by the faculty during training shall be as under:

f)	Maintenance of Training Diary and Regularity	10
g)	Relations with Seniors and others	10
h)	Overall Conduct	10
i)	Willingness to Work	10
j)	Proficiency achieved	10

		50

Course Articulation Matrix

CO Statement (PROJ-EC-800)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
PROJ-EC-800.1	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
PROJ-EC-800.2	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
PROJ-EC-800.3	3	3	2	3	3	2	2	3	3	3	3	2	3	3	3	3
PROJ-EC-800.4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
PROJ-EC-800.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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BCS-DS-727: DATA SCIENCE

Periods/week	Credits	Max. Marks	: 200
L :3 T: 0	3.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs		End Semester Examination	: 100

Pre-Requisite: Basic Knowledge of computers
Course Type: Program Electives

Course Outcomes:

BCS-DS-727.1 Describe a flow process for data science problems.
BCS-DS-727.2 Classify data science problems into standard typology.
BCS-DS-727.3 Correlate results to the solution approach followed.
BCS-DS-727.4 Construct use cases to validate approach and identify modifications required.
BCS-DS-727.5 Develop R codes for data science solutions.

PART –A

Unit-1. INTRODUCTION TO DATA SCIENCE:

1.1 Data science for engineers Course philosophy and expectation
1.2 Introduction to R
1.3 Variables and data types in R, Data frames
1.4 Recasting and joining of data frames
1.5 Arithmetic, Logical and Matrix operations in R
1.6 Control structures, Data visualization in R Basic graphics The study of language, applications of NLP

Unit-2. LINEAR ALGEBRA AND STATISTICAL MODELLING FOR DATA SCIENCE

2.1 Linear Algebra
2.2 Solving Linear Equation
2.3 Linear Algebra - Distance, Hyperplanes and Halfspaces, Eigen values, Eigen vectors
2.4 Statistical Modelling
2.5 Random Variables and Probability Mass/Density Functions
2.6 Sample Statistics
2.7Hypotheses Testing

Unit-3. Optimization for Data Science

3.1 Basics of Optimization
3.2 Unconstrained Multivariate Optimization
3.3. Unconstrained Multivariate Optimization
3.4 Gradient (Steepest) Descent (OR) Learning Rule
3.5 Multivariate Optimization With Equality Constraints
3.6 Multivariate Optimization With Inequality Constraints

PART –B

Unit-4. PREDICTIVE MODELLING AND REGRESSION FOR DATA SCIENCE
4.1 Module : Predictive Modelling
4.2 Linear Regression
4.3 Model Assessment
4.4 Diagnostics to Improve Linear Model Fit
4.5 Simple Linear Regression Model Building
4.6 Simple Linear Regression Model Assessment
4.7 Simple Linear Regression Model Assessment (Continued)
4.8 Muliple Linear Regression

Unit-5. VALIDATION AND LOGIGITIC REGRESSION
5.1 Cross Validation
5.2 Multiple Linear Regression Modeling Building and Selection
5.3 Classification
5.4 Logisitic Regression
5.5 Performance Measures
5.6 Logisitic Regression Implementation in R

Unit-6. KNN and Recent trends in various data collection and analysis techniques
6.1 K - Nearest Neighbors (kNN)
6.2 K - Nearest Neighbors implementation in R
6.3 K - means Clustering
6.4 K - means implementation in R
6.5 Recent trends in various data collection
6.6 Analysis techniques
6.7 Various visualization techniques
6.8 Application development methods of used in data science.

Text/Reference Books:
1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
End Term Examination

COURSE ARTICULATION MATRIX :

CO Statement(BCS-DS-727)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCS-DS-727.1	3	2	1	1	1	1	1	2	1	1	1	3	2	1	1
BCS-DS-727.2	1	3	1	1	3	1	1	1	1	1	1	2	1	1	1
BCS-DS-727.3	2	1	2	1	1	3	3	1	1	1	1	3	1	1	1
BCS-DS-727.4	1	2	2	3	1	2	2	1	1	2	1	2	2	1	2
BCS-DS-727.5	1	1	2	3	3	1	1	2	2	2	1	2	1	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEE-DS-741: PLC & DATA ACQUISITION

Periods/week	Credits	Max. Marks:200
L: 3 T: 0	3	Continuous Evaluation: 100
Duration of Examination: 3 Hrs		End Semester Examination: 100

Course Type: Elective

Course Outcomes

The students will be able to:

BEE-DS-741.1. Understand the concept of PLC and the Programming using Ladder diagram.
BEE-DS-741.2. Know the fundamentals of Data Acquisition system.
BEE-DS-741.3. Comprehend the basics of Distributed Control Systems.
BEE-DS-741.4. Analyze the basic concept of Virtual Instrumentation.
BEE-DS-741.5. Implement the basic concept of Telemetry.

PART-A

Unit 1: Programmable Logic Controller (PLC) Basics

1.1 Definition –Overview of PLC systems input/output modules- power supplies and isolators
1.2 General PLC programming procedures programming on-off inputs/ outputs
1.3 Auxiliary commands
1.4 Functions- PLC Basic Functions register basics
1.5 Timer functions
1.6 Counter functions

Unit 2: PLC Intermediate Functions

2.1 PLC intermediate functions: Arithmetic functions
2.2 Comparison functions - Skip and MCR functions
2.3 Data move systems
2.4 PLC Advanced intermediate functions: Utilizing digital bits- sequencer functions- matrix functions
2.5 PLC Advanced functions: Alternate programming languages
2.6 Analog PLC operation
2.7 Networking of PLC
2.8 PID functions
2.9 PLC installation
2.10 Troubleshooting and maintenance
2.11 Design of interlocks and alarms using PLC

Unit 3: Supervisory Control and Data Acquisition Systems (SCADA)

3.1 Data loggers
3.2 Data Acquisition Systems (DAS)
3.2 Direct Digital Control (DDC)
3.3 Need of SCADA system

3.4 General definition and SCADA components
3.5 Hardware Architecture
3.6 Software architecture
3.7 Protocol detail
3.8 Discrete control and Analog control
3.9 Application & benefits
3.10 PLCs Vs RTUs
3.11 RTU Block diagram
3.12 MTU communication Interface
3.13 Future trends
3.14 Internet based SCADA display system
3.15 Components of control systems in SCADA

PART-B

Unit 4: Introduction to (DCS)

4.1 Distributed Control Systems (DCS)
4.2 Definition - Local Control Unit (LCU) architecture , LCU languages ,LCU Process
4.3 Interfacing issues
4.4 Communication facilities
4.5 Redundancy concept

Unit 5: Basics of Virtual Instrumentation

5.1 Historical Perspective
5.2 Need/ Advantages of VI
5.3 Defining VI
5.4 Block Diagram & architecture of VI
5.5 Data Flow Techniques
5.6 Graphical Programming in Data Flow
5.7 Comparison with conventional programming

Unit 6: Data Transmission & Telemetry systems

6.1 Methods of Data Transmission
6.2 Telemetry Systems analog / digital & short / long distance type
6.3 Electrical Telemetry Systems
6.4 Pulse telemetry systems
6.5 Analog: PAM, FM, PDM & PPM
6.6 Digital: PCM
6.7 Transmission channels & Media
6.8 Multiplexing in telemetry system: TDM & FDM technique

Text Books / Reference Books:

1. Programmable Logic Controllers - Principles and Applications, John.W. Webb, Ronald A Reis, Prentice Hall Inc., New Jersey, 2003.
2. Instrument Engineers Hand, Process control and Optimization, B.G. Liptak, CRC press- Radnor, Pennsylvania, 2006.
3. Computer Control of Process, M.Chidambaram, Narosa Publishing, New Delhi, 2003.
4. Electrical and Electronic measurement and Instrumentation – by A. K. Sawhney, Dhanpat Rai & Co. (P) Limited; 2014 edition.
5. Process software and digital networks, B.G. Liptak, CRC press,Florida-2003.
6. Johnson Process control instrumentation technology, Curtis D. Prentice Hall , New Jersey 2006.

7. Computer-Based Industrial Control, Krishna Kant, PHI, New Delhi, 2004.
8. Programmable Logic Controllers, Frank D. Petruzella, McGraw Hill, New York, 2004.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Software required/Weblinks:

MATLAB
nptel.ac.in/downloads/108105063/

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation matrix

CO Statement (EE-741)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BEE-DS-741.1	3	3	2	2	1	1	1	-	-	-	-	-	2	1	1	1
BEE-DS-741.2	3	3	2	2	1	1	1	-	-	-	-	-	2	1	1	1
BEE-DS-741.3	3	3	2	2	1	1	1	-	-	-	-	-	2	1	1	1
BEE-DS-741.4	3	3	2	2	1	1	1	-	-	-	-	-	2	1	1	1
BEE-DS-741.5	3	3	2	2	1	1	1	-	-	-	-	-	2	1	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BCS-DS-823: Computational Linguistics and Natural Language Processing

Periods/week Credits	Max. Marks : 200
L :3 T: 0 3.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End SemesterExamination : 100

Pre-Requisite: Basic Knowledge of computers
Course Type: Electives

Course Outcomes:
BCS-DS-823.1 Describe the basic concept of Natural Language Understanding and different level of Language Analysis.
BCS-DS-823.2 Discuss the Morphological Analysis and The Lexicon.
BCS-DS-823.3 Interpret the behavior of different parsing algorithms with Languages.
BCS-DS-823.4 Understanding the grammar with help of Lexicon theory.
BCS-DS-823.5 Analysis of wordnet theory with help of languages.
BCS-DS-823.6 Develop system for Indian language.

PART- A

Unit-1. INTRODUCTION TO NATURAL LANGUAGE UNDERSTANDING:
1.1 The study of language, applications of NLP
1.2 Evaluating language understanding systems
1.3 Different levels of language analysis
1.4 Representations and understanding
1.5 Organization of natural language understanding systems
1.6 Llinguistic background: an outline of English syntax.

Unit-2. MORPHOLOGICAL ANALYSIS AND THE LEXICON
2.1 Morphology fundamentals
2.2 Morphological Diversity o f Indian Languages
2.3 Morphology Paradigms
2.4 Finite State Machine Based Morphology
2.5 Automatic Morphology Learning
2.6 Shallow Parsing; Named Entities

Unit-3. GRAMMARS AND PARSING:
3.1Grammars and sentence structure
3.2 Theories of Parsing
3.3. Parsing Algorithms (Top-down and Bottom-up parsers)
3.4 Robust and Scalable Parsing on Noisy Text as in Web documents
3.5 Hybrid of Rule Based and Probabilistic Parsing
3.6 Probabilistic context-free grammars, best first parsing

PART- B

Unit-4. GRAMMARS AND MEANING FOR NATURAL LANGUAGE:
4.1 Auxiliary verbs and verb phrases
4.2 Movement phenomenon in language
4.3 Handling questions in context-free grammars
4.4 Lexical Knowledge Networks
4.5 Wordnet Theory
4.6 Indian Language Wordnets and Multilingual Dictionaries

Unit-5. HUMAN PREFERENCES IN PARSING
5.1 Encoding uncertainty
5.2 Deterministic parser
5.3 Word level morphology and computational phonology
5.4 Basic text to speech
5.5 Introduction to HMMs and speech recognition
5.6 Parsing with CFGs; probabilistic parsing

Unit-6. AMBIGUITY RESOLUTION
6.1 Statistical methods
6.2 Estimating probabilities
6.3 Part-of- speech tagging
6.4 Obtaining lexical probabilities
6.5 Scope Ambiguity and Attachment Ambiguity resolution.
6.6 Word senses and ambiguity, encoding ambiguity in logical form, Indian language case studies.

Text Books / Reference Books:
1 . Allen James, 2003, "Natural Language Understanding", 2nd edition, Pearson Education.
2. Ela Kumar "" Natural Language Processing ", I.K International Publication House.
3. Siddiqui Tanveer and Tiwary U. S., 2008, "Natural Language Processing and Information Retrieval", Oxford University Press.
4. Winograd Terry, 1983, "Language as a Cognitive Process", Addison Wesley.
5. Gazder G., 1989 "Natural Language Processing in Prolog", Addison Wesley.
6. Jurafsky D. and Martin J. H.,2002 "Speech and Language Processing", Pearson Education.
7. Manning Christopher D. and Schütze Hinrich, 1999 "Foundations of Statistical Natural Language Processing", The MIT Press, Cambridge, Massachusetts.
8. Dickinson, Brew, and Meuers 2013, Language and Computers.
9. Bender 2013 Linguistic Fundamentals for Natural Language Processing.

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX :

CO Statement (BCS-DS-823.1)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
BCS-DS-823.1	3	2	1	1	1	1	1	2	1	1	1	3	2	1	1
BCS-DS-823.2	1	3	1	1	3	1	1	1	1	1	1	2	1	1	1
BCS-DS-823.3	2	1	2	1	1	3	3	1	1	1	1	3	1	1	1
BCS-DS-823.4	1	2	2	3	1	2	2	1	1	2	1	2	2	1	2
BCS-DS-823.5	1	1	2	3	3	1	1	2	2	2	1	2	1	1	1
BCS-DS-823.6	1	1	3	1	2	1	1	2	3	1	2	2	2	3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-811: IMAGE PROCESSING AND APPLICATIONS

Periods/week Credits	Max. Marks	: 200
L :3 T: 0 3.0	Continuous Evaluation	: 100
Duration of Examination: 3 Hrs	End Semester Examination	: 100

Course Type: Elective

Course Outcomes
The students will be able to:

BEC-DS-811.1. Understand and apply basic principles and applications of digital image processing.
BEC-DS-811.2. Get comprehensive background of Image Enhancement in spatial domain and frequency domain.
BEC-DS-811.3. Apply mathematical principles of image restoration, segmentation, feature detection and contour finding algorithms.
BEC-DS-811.4. Implement the concepts of Image Representation, Description and Recognition.
BEC-DS-811.5 Classify and apply the concepts of Image transforms and compression schemes.

PART-A

Unit 1: Introduction and Fundamental to Digital Image Processing

1.1 Basic Concepts of Digital Image Processing, Applications of Digital Image Processing
1.2 Fundamental steps in Digital Image Processing, Components of Digital Image Processing System
1.3 Image sampling, Image quantization

Unit 2: Image Enhancement in Spatial Domain

2.1 Background, spatial domain methods
2.2 Image enhancement by point processing: Identity transformation
2.3 Digital negative, contrast stretching
2.4 Thresholding, log transformation, power law transformation
2.5 Image enhancement by neighborhood processing, Image Smoothing
2.6 Low pass filter, High pass filter, Histogram processing, Histogram equalization

Unit 3: Image Enhancement in Frequency Domain

3.1 1D Fourier Transform, 2D Fourier Transform
3.2 Image Smoothing low pass frequency domain filters-Butterworth LPF, Gaussian LPF
3.3 Sharpening high pass Frequency-Domain filters: Butterworth HPF, Gaussian HPF

PART-B

Unit 4: Image Restoration

4.1 Image Degradation/Restoration Process
4.2 Noise models: Gaussian noise, Exponential noise, Salt and pepper noise and Uniform noise
4.3 Image Restoration in presence of noise, Inverse Filtering
4.4 Minimum Mean Square Filtering, Geometric mean filter

Unit 5: Image Compression and Segmentation

5.1 Fundamentals of Image Compression, Image compression model
5.2 Types of Compression: Lossy compression: Transform coding
5.3 Lossless compression: Run length Encoding, Image Segmentation: Detection of Discontinuities
5.4 Edge linking and boundary detection, Thresholding : Global and Local

Unit 6: Image Representation, Description and Recognition

6.1 Representation-chain codes, Boundary descriptors-simple descriptors
6.2 Shape numbers, Regional descriptors- simple, topological descriptors
6.3 Pattern and object recognition system, Recognition based on matching techniques

Text Books/ Reference Books:

1. Rafael C.Gonzalez and Richard E. Woods , Digital Image Processing, 2002, 2nd Edition, Pearson Education.
2. Anil K. Jain , Fundamentals of Digital Image Processing , 2004, 2nd Edition, PHI Learning.

Software required/Weblinks:

MATLAB
http://nptel.ac.in/courses/117105079/

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-811)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-811.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-811.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-811.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-811.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-811.5	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-812: NANOTECHNOLOGY

Periods/week Credits	Max. Marks : 200
L :3 T: 0 3.0	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination : 100

Course Type: Program Electives

Course Outcomes

The students will be able to:

BEC-DS-812.1 Understand the fundamentals of Nanotechnology and its potentialities.
BEC-DS-812.2. Analyze general introduction of properties of nanostructures along with its classes.
BEC-DS-812.3. Explain various techniques of synthesis of nanomaterials.
BEC-DS-812.4 Comprehend various characterization techniques of nanomaterials.

PART-A

Unit 1: Basics and Scale of Nanotechnology

1.1 Introduction, Scientific revolutions, Time and length scale in structures
1.2 Definition of a nanosystem
1.3 Bottom-up and Top-Down Approaches
1.4 Challenges in Nanotechnology

Unit 2: Properties of Nanostructures

2.1 Dimensionality and size dependent phenomena, Surface to volume ratio, Fraction of surface atoms, Surface energy and surface stress, surface defects
2.2 Properties at nanoscale (optical, mechanical, electronic and magnetic)

Unit 3: Different Classes of Nano materials

3.1 Classification based on dimensionality-Quantum Dots, Wells and Wires
3.2 Carbon based nano materials (bucky balls, nano tubes, graphene)
3.3 Metal based nano materials (nano gold, nano silver and metal oxides), Nanocomposites, Nano polymers, Nanoglasses, Nano ceramics ,Biological nanomaterials

PART-B

Unit 4: Synthesis of Nanomaterials

4.1Chemical Methods: Metal Nanocrystals by Reduction, Solvothermal Synthesis, Sonochemical

Routes- Chemical VaporDeposition (CVD), Physical VaporDeposition (PVD)
4.2 Physical Methods: Ball Milling, Electrodeposition, Pyrolysis - DC/RF Magnetron Sputtering, Molecular Beam Epitaxy (MBE)

Unit 5: Fabrication and Characterization of Nanostructures

5.1 Nanofabrication: Photolithography and its limitation-Electron-beam lithography (EBL), Nanoimprint, of lithography patterning
5.2 Characterization: (Microscopic methods) Scanning Electron Microscopy (SEM) High Resolution Transmission Electron Microscope (HRTEM), Scanning Tunneling Microscope (STM)
5.3 (Spectroscopic methods) Surface enhanced Raman spectroscopy (SERS), X-ray Photoelectron Spectroscopy (XPS) , Auger electron spectroscopy (AES) , Rutherford backscattering spectroscopy (RBS)

Unit 6: Applications

6.1 Solar energy conversion and catalysis, Molecular electronics and Nano electronics
6.2 Nanobots, Optical applications, Applications in displays and other devices, Nanomaterials for data storage , Photonics, Plasmonics, Chemical and biosensors
6.3 Nano medicine and Nano biotechnology, Nano toxicology challenges

Text Books/Reference Books:

1. Pradeep T , 2012, A Textbook of Nanoscience and Nanotechnology, 1st Edition, Tata McGraw Hill Education Pvt. Ltd.
2. Hari Singh Nalwa, 2002, Nano structured Materials and Nanotechnology, Concise Edition, Academic Press.
3. Nabok A, 2005, Organic and Inorganic Nanostructures, 2nd Edition, Artech House.
4. Cao G , 2004, Nanostructures and Nano materials, 2ndEdition, Imperial College Press.

Software required/Weblinks:

http://nptel.ac.in/courses/117108047/31

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-812)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-812.1	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-812.2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-812.3	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-
BEC-DS-812.4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	-	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

BEC-DS-813: VERIFICATION WITH UNIVERSAL VERIFICATION METHODOLOGY

Periods/week Credits	Max. Marks : 200
L: 3 T: 0 3	Continuous Evaluation : 100
Duration of Examination: 3 Hrs	End Semester Examination: 100

Course Type: Program Core

Course Outcomes

The students will be able to
BEC-DS-813.1: Understand the UVM concepts and explore the class instances and functions
BEC-DS-813.2: Comprehend the UVM Configurations
BEC-DS-813.3: Analyze UVM sequences and Modeling
BEC-DS-813.4 Developing Reusable Test benches using UVM and analyze the Case studies of Layered test bench for SPI, APB and AXI

PART-A

Unit 1 : UVM Methodology

1.1 UVM Methodology Concepts: Methodologies, Evolution of Verification methodologies
1.2 Introduction to UVM, Overview of UVM Environment
1.3 UVM Library, UVM Phasing
1.4 UVM Reporting , UVM Transactions, TLM Basics.

Unit 2 : OOPs Concepts

a. Declaring and using class instances, including static members
b. Class inheritance and aggregation (composite classes)
c. Class property randomization, Randomization constraints
d. Relational and distribution constraints
e. Conditional Subprograms, including void functions.

Unit 3 : UVM Configuration

3.1 Details of UVM Configuration
3.2 UVM Driver, UVM Sequence
3.3 Sequencer and Virtual Sequencers, UVM Monitor
3.4 UVM Agent, UVM Factory
3.5 UVM Callbacks, UVM Register layer.

PART-B

Unit 4 : UVM sequences

4.1 Details of UVM Sequences
4.2 Connecting to a DUT, Interface and module UVCs
4.3 Multichannel sequences (virtual sequences), Building a scoreboard
4.4 Transaction-level modeling (TLM), Functional coverage modeling
4.5 Register Modeling in UVM.

Unit 5: UVM Modeling

5.1 Developing Reusable Testbenches using UVM:Modeling
5.2 Data Items for Generation, Creating the Driver
5.3 Creating the Sequencer, Creating the Monitor
5.4 Instantiating Components, Creating the Agent
5.5 Creating the Environment, Transaction-Level Components
5.6 Enabling Scenario Creation, Managing End of Test
5.7 Implementing Checks and Coverage.

Unit 6 : Case Study

6.1 Case studies of Layered testbench for SPI, APB and AXI.

Text Books/ Reference Books:

1. Ray Salemi , The UVM Primer: A Step-by-Step Introduction to the Universal Verification Methodology.
2. Sharon Rosenberg & Kathleen A Meade , A Practical Guide to Adopting Universal Verification Methodology (UVM) ,2nd Edition.

Software required/Weblinks:
Active-HDL
ISE Simulator
ModelSim and Questa
Xilinx Simulator
https://www.accellera.org/images//downloads/standards/uvm/uvm_users_guide_1.2.pdf

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

Distribution of Continuous Evaluation:

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

Evaluation Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

CO Statement (BEC-DS-813)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
BEC-DS-813.1	1	1	1	1	2	-	-	-	-	-	-	2	1	2	-	-
BEC-DS-813.2	1	1	2	1	3	-	-	-	-	-	-	2	2	3	-	-
BEC-DS-813.3	1	2	3	3	3	-	-	-	-	-	-	3	2	3	-	-
BEC-DS-813.4	2	2	3	3	3	-	-	-	-	-	-	3	2	3	-	-

Appendix-A : List of courses having relevance to the Local/Regional, National and Global Development needs

Course Code	Course Name	Regional	National	Global
BPH-106	Physics for Engineers			√
BMA-102	Mathematics- 1			√
BEE-101A	Basic Electrical Engineering			√
BME-101A	Engg Graphics & Design			√
BPH-151A	Physics lab			√
BEE-151A	Basic Electrical Engg lab			√
BCS-100	AI for Engineers			√
BHM-101	English			√
BHM-MC-001	Constitution of India			√
BCH-106	Chemistry for Engineers			√
BMA-202	Mathematics- 2			√
BME- 102	Workshop Manufacturing Practices			√
BBT-100	Biology for Engineers			√
BCH-151A	Chemistry lab			√
BHM-151	English lab		√	
BCH-MC-002	EVS		√	
BCS-101A	Programming for Problem Solving			√
BCS-151A	Programming for Problem Solving lab			√
BEC-DS-301A	Electronic Devices			√
BEC-DS-302	Digital Electronics		√	
BEC-DS-303A	Signals & Systems			√
BCS-DS-301	Data Structure & Algorithms		√	
BEE-DS-301	Electrical Circuit & Analysis		√	
BHM-001A	Cyber Law & Ethics			√
BEC-DS-351	Electronic Devices Lab			√
BEC-DS-352	Digital Electronics Lab			√
BCS-DS-351	Data Structure & Algorithms Lab			√
DTI-300	Design Thinking and Innovation-I			√
BHM-MC-004	Quantitative Aptitude			√
Proj-EC-300A*	Summer Internship-I		√	
BEC-DS-201	* IoT Design with Arduino			√
BEC-DS-251	* IoT Design with Arduino Lab	√		
BEC-DS-401A	Communication Engineering	√		

BEC-DS-402	Analog Circuits			√
BEC-DS-403	Microprocessors & Microcontrollers			√
BEC-DS-404A	Electromagnetic Waves			√
BCS-DS-474	Java Programming			√
BEC-DS-451	Communication Engineering Lab			√
BEC-DS-452	Analog Circuits Lab		√	
BHM-320	Universal Human Values: 2		√	
BHM-MC-002	Sports and Yoga		√	
BEC-DS-453	Microprocessors & Microcontroller Lab		√	
DTI-400	Design Thinking and Innovation-II			√
BHM-MC-006	QAPD-I			√
BEC-DS-304	* Python Programming and Raspberry Pi Fundamentals			√
BEC-DS-354	* Python Programming and Raspberry Pi Fundamentals Lab			√
BEC-DS-503A	Antennas			√
BEC-DS-501A	Digital Signal Processing and its Applications			√
BEC-DS-508	Probability and Stochastic Processes			√
BEC-DS-551A	Digital Signal Processing and its Applications Lab			√
Proj-EC-400*	Summer Internship-II		√	
BHM-520	Entrepreneurship and Startups			√
DTI-500	Design Thinking and Innovation-III			√
BHM-MC-008	QAPD-II			√
BEC-DS-406	* Artificial Intelligence			√
BEC-DS-456	* Artificial Intelligence Lab			√
BMA-308	Mathematics-3			√
BEC-DS-521	VHDL			√
BEC-DS-522	Wireless Communication			√
BCS-DS-503	Artificial Intelligence			√
BEC-DS-716	Android			√
BCS-DS-404	Data Base Management Systems			√

HM-506/HM-507/ HM-508	Generic Elective I (French I/ German I/ Spanish I)			√
BCS-DS-427A	Python			√
BCS-DS-479A	Python Lab		√	
BEC-DS-606	Data Communication and Networking			√
PROJ-EC-600	Project Phase - I			√
BEE-DS-502	Control Systems			√
BHM-MC-009	QAPD-III			√
BEC-DS-505	* Machine Learning			√
BEC-DS-555	* Machine Learning Lab			√
BEC-DS-601	Embedded Systems			√
BEC-DS-602	Mobile Communication			√
BEC-DS-651	Embedded Systems Lab			√
BEC-DS-652A	Simulation Lab			√
BEC-DS-614	Fiber Optics		√	
BEC-DS-621	RTL Design Synthesis Using Verilog			√
BCS-DS-403	Operating Systems			√
BEC-DS-611	Microwave Theory and Techniques			√
HM-606/HM-607/ HM-608	Generic Elective II (French II/ German II/ Spanish II)			√
PROJ-EC-600*	Summer Internship-III			√
GP-EC-700	General Proficiency			√
Proj-EC-700*	Project Phase - II/Industrial Project			√
BEC-DS-603	* Deep Learning			√
BEC-DS-653	* Deep Learning Lab			√
BEC-DS-701	High Performance Computing			√
BEC-DS-751	High Performance Computing Lab			√
BCS-DS-602	Machine Learning			√
BEC-DS-715	Satellite Communication			√

BEC-DS-718	Advanced Communication Lab			√
BEC-DS-721	Digital CMOS VLSI Design			√
BEC-DS-713	Robotics		√	
BEC-DS-712	Radar & Navigation		√	
BEC-DS-717	Robotics Lab		√	
BEC-DS-702	AI & IoT for Practitioners Using NVIDIA Jetson Nano Board		√	
BEC-DS-752	AI & IoT Lab for Practitioners Using NVIDIA Jetson Nano Board		√	
BEC-DS-518	Soft Computing Techniques		√	
BEC-DS-516	IOT Analytics & Security			√
Proj-EC-800*	Internship (24 weeks Training)			√
BCS-DS-727	Data Science		√	
BEE-DS-741	PLC & Data Acquisition		√	
BCS-DS-823	Computational Linguistics and Natural Language Processing			√
BEC-DS-811	Image Processing and Applications			√
BEC-DS-812	Nanotechnology	√		
BEC-DS-813	Verification Using UVM	√		

Appendix B: List of courses having focus on Employability, Entrepreneurship and Skill Development

Course Code	Course Name	Employability	Entrepreneurship	Skill development
BPH-106	Physics for Engineers			√
BMA-102	Mathematics- 1			√
BEE-101A	Basic Electrical Engineering			√
BME-101A	Engg Graphics & Design			√
BPH-151A	Physics lab			√
BEE-151A	Basic Electrical Engg lab			√
BCS-100	AI for Engineers			√
BHM-101	English			√
BHM-MC-001	Constitution of India			√
BCH-106	Chemistry for Engineers			√
BMA-202	Mathematics- 2			√
BME- 102	Workshop Manufacturing Practices			√
BBT-100	Biology for Engineers			√
BCH-151A	Chemistry lab			√
BHM-151	English lab			√
BCH-MC-002	EVS			√
BCS-101A	Programming for Problem Solving			√
BCS-151A	Programming for Problem Solving lab		√	√
BEC-DS-301A	Electronic Devices			√
BEC-DS-302	Digital Electronics		√	
BEC-DS-303A	Signals & Systems		√	√
BCS-DS-301	Data Structure & Algorithms		√	
BEE-DS-301	Electrical Circuit & Analysis		√	
BHM-001A	Cyber Law & Ethics			√
BEC-DS-351	Electronic Devices Lab			√
BEC-DS-352	Digital Electronics Lab			√
BCS-DS-351	Data Structure & Algorithms Lab			√
DTI-300	Design Thinking and Innovation-I			√
BHM-MC-004	Quantitative Aptitude			√
Proj-EC-300A*	Summer Internship-I		√	
BEC-DS-201	* IoT Design with Arduino			√
BEC-DS-251	* IoT Design with Arduino Lab	√		

BEC-DS-401A	Communication Engineering	√		
BEC-DS-402	Analog Circuits			√
BEC-DS-403	Microprocessors & Microcontrollers			√
BEC-DS-404A	Electromagnetic Waves			√
BCS-DS-474	Java Programming			√
BEC-DS-451	Communication Engineering Lab			√
BEC-DS-452	Analog Circuits Lab		√	
BHM-320	Universal Human Values: 2		√	
BHM-MC-002	Sports and Yoga		√	
BEC-DS-453	Microprocessors & Microcontroller Lab		√	
DTI-400	Design Thinking and Innovation-II			√
BHM-MC-006	QAPD-I			√
BEC-DS-304	* Python Programming and Raspberry Pi Fundamentals			√
BEC-DS-354	* Python Programming and Raspberry Pi Fundamentals Lab			√
BEC-DS-503A	Antennas			√
BEC-DS-501A	Digital Signal Processing and its Applications			√
BEC-DS-508	Probability and Stochastic Processes			√
BEC-DS-551A	Digital Signal Processing and its Applications Lab			√
Proj-EC-400*	Summer Internship-II		√	
BHM-520	Entrepreneurship and Startups			√
DTI-500	Design Thinking and Innovation-III			√
BHM-MC-008	QAPD-II			√
BEC-DS-406	* Artificial Intelligence			√
BEC-DS-456	* Artificial Intelligence Lab			√
BMA-308	Mathematics-3			√
BEC-DS-521	VHDL			√
BEC-DS-522	Wireless Communication	√		
BCS-DS-503	Artificial Intelligence			√
BEC-DS-716	Android			√

BCS-DS-404	Data Base Management Systems			√
HM-506/HM-507/ HM-508	Generic Elective I (French I/ German I/ Spanish I)			√
BCS-DS-427A	Python			√
BCS-DS-479A	Python Lab		√	
BEC-DS-606	Data Communication and Networking			√
PROJ-EC-600	Project Phase - I			√
BEE-DS-502	Control Systems			√
BHM-MC-009	QAPD-III			√
BEC-DS-505	* Machine Learning			√
BEC-DS-555	* Machine Learning Lab			√
BEC-DS-601	Embedded Systems			√
BEC-DS-602	Mobile Communication			√
BEC-DS-651	Embedded Systems Lab			√
BEC-DS-652A	Simulation Lab			√
BEC-DS-614	Fiber Optics		√	
BEC-DS-621	RTL Design Synthesis Using Verilog			√
BCS-DS-403	Operating Systems			√
BEC-DS-611	Microwave Theory and Techniques			√
HM-606/HM-607/ HM-608	Generic Elective II (French II/ German II/ Spanish II)			√
PROJ-EC-600*	Summer Internship-III			√
GP-EC-700	General Proficiency			√
Proj-EC-700*	Project Phase - II/Industrial Project			√
BEC-DS-603	* Deep Learning			√
BEC-DS-653	* Deep Learning Lab			√
BEC-DS-701	High Performance Computing			√
BEC-DS-751	High Performance Computing Lab	√		
BCS-DS-602	Machine Learning	√		

BEC-DS-715	Satellite Communication			√
BEC-DS-718	Advanced Communication Lab			√
BEC-DS-721	Digital CMOS VLSI Design			√
BEC-DS-713	Robotics		√	
BEC-DS-712	Radar & Navigation		√	
BEC-DS-717	Robotics Lab		√	
BEC-DS-702	AI & IoT for Practitioners Using NVIDIA Jetson Nano Board		√	
BEC-DS-752	AI & IoT Lab for Practitioners Using NVIDIA Jetson Nano Board		√	
BEC-DS-518	Soft Computing Techniques		√	
BEC-DS-516	IOT Analytics & Security			√
Proj-EC-800*	Internship (24 weeks Training)			√
BCS-DS-727	Data Science			√
BEE-DS-741	PLC & Data Acquisition			√
BCS-DS-823	Computational Linguistics and Natural Language Processing		√	
BEC-DS-811	Image Processing and Applications		√	
BEC-DS-812	Nanotechnology			√
BEC-DS-813	Verification Using UVM			√

Appendix C: List of courses and proposed activities relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability

Course Code	Course Name	Environmental Sustainability	Gender Sensitization	Professional	Human Values
BHM-001A	Cyber Law & Ethics		√		
BHM-320	Universal Human Values: 2				√
BCH-MC-002	EVS	√			