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UNIVERSITY OF MYSORE

Estd.1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

(Re-accredited by NAAC at 'A')

(NIRF-2023 Ranked 44 in University Category & 71 in Overall Category)

No.: PMEB-1/Spl./10(4)/2023-24 **Date: 18-07-2024**

NOTIFICATION

Sub.: Syllabus and Examination pattern of **B.Sc. (Hons.)(Artificial Intelligence and Machine Learning) course** under Specialized Programme from the academic year 2024-25-reg.

Ref.: 1. Decision of the BOS Meetings held on 29-01-2024.
2. Decision of the Faculty of Science & Technology meeting held on 19-06-2024.
3. Decision of the Academic Council meeting held on 28-06-2024.

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The Board of Studies in **B.Sc.(Hons.)(Artificial Intelligence and Machine Learning) (UG)** at its meeting held on 29-01-2024 has recommended the approval of the 2nd and 3rd year Syllabus and Examination pattern of **B.Sc.(Hons.)(Artificial Intelligence and Machine Learning)** course in University of Mysore under specialized/specified programs from the academic year 2024-25 as per NEP-2020.

The Faculty of Science & Technology and the Academic Council at their meetings held on 19-06-2024 and 28-06-2024 respectively, have also approved the above proposal and the same is hereby notified.

The 2nd and 3rd year Syllabus and Examination pattern of **B.Sc.(Hons.)(Artificial Intelligence and Machine Learning)** course may be downloaded from the University website **https://uni-mysore.ac.in/PMEB/.**

REGISTRAR

REGISTRAR
University of Mysore
MYSURU-570 005

To,

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DoS in Mathematics, Manasagangotri, Mysuru.
3. Prof. Suresha, DoS in Computer Science, Manasagangothri, Mysuru.
4. The Principal, Marian Institute of Professional Studies (MIPS), MIT Campus, Belawadi, Srirangapatna Tq., Mandya Dist.
5. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
7. Office Copy.

COURSE STRUCTURE – B.Sc. (Artificial Intelligence and Machine Learning)

SEMESTER	CORE - DSCC		ELECTIVE				ABILITY ENHANCEMENT COURSES				TOTAL CREDIT
			DSE		OE		SEC/ VB		AECC		
	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	
SEM III	**DSCC 7** (BAM17) **DSCC 8** (BAM18) **DSCC 9** (BAM19) **DSCC 10** (BAM21)	4 4 4 4	**DSEC I** (BAM20)	4			**SEC 3**	2			**22**
SEM IV	**DSCC 11** (BAM22) **DSCC 12** (BAM23) **DSCC 13** (BAM24) **DSCC13 Lab** (BAM26) **DSCC11 Lab** (BAM27)	4 4 3 3 3					**SEC 4** Project – Phase I	3	**AECC 7** (BAM25)	4	**24**

DSCC: Discipline Specified Core Courses
DSEC: Discipline Specified Elective Courses
OEC: Open Elective Courses

SEC: Skill Enhancement Course, VBC= Value Based Courses
AECC: Ability Enhancement Compulsory Courses

COURSE STRUCTURE – B.Sc. (Artificial Intelligence and Machine Learning)

SEMESTER	CORE - DSCC		ELECTIVE				ABILITY ENHANCEMENT COURSES				TOTAL CREDIT
			DSE		OE		SEC/ VB		AECC		
	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	COURSE	CREDIT	
SEM V	**DSCC 14** (BAM28) **DSCC 15** (BAM29) **DSCC 16** (BAM30) **DSCC 14 Lab** (BAM33)	4 4 3 3	**DSEC II** (BAM32)	3			**SEC 5**	2	**AECC 8** (BAM31)	3	**22**
SEM VI	**DSCC 17** (BAM34) **DSCC 18** (BAM35) **DSCC 19** (BAM37) **DSCC 20** (BAM38) **DSCC21** (BAM39) (Main Project)	4 4 4 4 4	**DSEC III** (BAM36)	4							**24**

DSCC: Discipline Specified Core Courses
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SEC: Skill Enhancement Course, VBC= Value Based Courses
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UNIVERSITY OF MYSORE

B.Sc. Artificial Intelligence and Machine Learning

SYLLABUS

NEP 2020

IMPLEMENTED FROM THE

ACADEMIC YEAR 2023-24

SYLLABUS FOR B.Sc. (Artificial Intelligence and Machine Learning) DEGREE AS PER NEP – 2020 REGULATIONS IMPLEMENTED FROM THE ACADEMIC YEAR 2023-24

I. OBJECTIVES:

a. To familiarize the students with various approaches, methods and techniques of Animation Technology.
b. To Apply analytical and critical thinking to identify, formulate, analyse, and solve complex problems in order to reach authenticated conclusions.
c. To Apply the technical and critical thinking skills in the discipline of artificial intelligence and machine learning to find solutions for complex problems.
d. To Understand what the latest generation of Artificial Intelligence can do with the decision-making process and accrue the qualities of a good leader.
e. To determine the problems where artificial intelligence techniques are applicable.
f. To enable students to participate in the design of systems that act intelligently and learn from experience.
g. To provide efficient and re-defined workforce that enables less manual and paper work, quick responses, change of public administration, provide better solutions
h. To develop expertise in Design and develop research-based solutions for complex problems in artificial intelligence and machine learning industry through appropriate consideration for the public health, safety, cultural, societal, and environmental concerns.

Preamble

Education is crucial in the formation of a nation. In our country, there are numerous educational institutions that provide guidance and training to impart quality education. However, our current educational system produces youth who must compete locally, regionally, nationally, and globally. The twenty-first century has brought many new challenges to the field of higher education. The current perilous situation necessitates system transformation and/or redesign, not only by introducing innovations but also by developing a "learner-centric" approach. However, the majority of our higher education institutions have followed a system that restricts students' ability to study subjects/courses. It should be comprehensive in order to develop the student into an ideal human being and useful person in society. Higher education's goal is to develop good, well-rounded, and creative individuals. It must allow an individual to study one or more specialised areas of interest in greater depth, while also developing character, ethical and constitutional values, intellectual curiosity, a spirit of service, and capabilities across disciplines such as sciences, social sciences, arts, humanities, and professional, technical, and vocational crafts.

The National Education Policy (NEP) has introduced several reforms in Indian education, including broad-based multidisciplinary Undergraduate Education with 21st Century skills and the development of specialised knowledge with disciplinary intellectual rigour. Its goal is to improve the National Higher Education System's equity, efficiency, and academic excellence. The most important ones are course curriculum innovation and improvement, paradigm shifts in learning and teaching pedagogy, evaluation, and education system.

Hence the University of Mysore thought it fit to implement the multidisciplinary and holistic education in all the under-graduate programs and the consequential post-graduate programs, with multiple entry and exit options with multiple certificate/diploma/degrees in the Faculties of Arts, Science, Commerce and Management to replace the present undergraduate degree programs effective from the academicyear2021-22.So based on the initiative of MHRD, the Marian Institute of Professional Studies (MIPS) run by Godwins Institution Private Ltd, has decided to follow the Multi-Disciplinary Under graduate Program with multiple exit and entry options with certificate/Diploma/degrees at each of the existing programs. Undergraduate courses should emphasise creativity and innovation, critical thinking and higher order thinking skills, problem solving abilities, teamwork, communication skills, more in-depth learning, and mastery of curriculum content across fields.

The proposed four-year multidisciplinary undergraduate programme is a fundamental transformation of current undergraduate education that replaces the traditional undergraduate programmes of the state's universities while also attempting to empower students and assist them in their pursuit of overall excellence. Students will be able to graduate after one year with a certificate, two years with a diploma, and three years with a bachelor's degree. The completion of the four-year programme will result in the award of a bachelor's degree with honors in specific subjects. In colleges, continuation of the undergraduate programme for the fourth year is optional in subjects however, it is the preferred option.

Salient Features of four-year multidisciplinary undergraduate programme

- The program shall be structured in a semester mode with multiple exit options with Certification, Diploma and Basic Bachelor Degree at the completion of first, second and third years, respectively. The candidate who completes the four years Undergraduate Program, either in one stretch or through multiple exits and re-entries would get a Bachelor's degree with Honors.
- The four years undergraduate Honors degree holders with research component and a suitable grade are eligible to enter the 'Doctoral (Ph.D.) Program' in a relevant discipline or to enter 'Two Semester Master's Degree programme with project work'.
- Candidates who wish to enter the master's/doctoral programme in a discipline other than the major discipline studied at the undergraduate programmes, have to take additional courses in the new discipline to meet the requirement or to make up the gap between the requirement and the courses already studied.
- There may be parallel five-year integrated master's degree programmes with exit options at the completion of third and fourth years, with the undergraduate degree and undergraduate degree with honours in a discipline, respectively.
- There may also be an integrated doctoral programme with exit option at the end of the first year with the Master's degree
- The students who exit with Certification, Diploma and Basic Bachelor Degree shall be eligible to re-enter the programme at the exit level to complete the programme or to complete the next level.
- The curriculum combines conceptual knowledge with practical engagement and understanding that has relevant real-world application through practical laboratory work, field work, internships, workshops and research projects.

The Four-Year Choice Based Credit System Semester Scheme makes the product of a university at par with the global practices in terms of academic standards and evaluation strategies. In the emerging scenario of Internationalization of Indian Higher Education, it is imperative that the Universities in India should follow this system so that the mobility of theirproducts both within and across the geographical jurisdiction becomes possible.

2. NAME OF THE PROGRAMME

2.1 The name of the programme is **B.Sc. (Artificial Intelligence and Machine Learning)**

2.2 The following Regulations are applicable to all the students who are taking admission for the first semester from 2023-24 Academic year as per the NEP Regulations 2020.

2.3 The duration of each semester is extended over a period of 16 weeks (90 working days) except training period (twenty-two weeks). The total duration of a semester is twenty weeks inclusive of semester end examination

3.ELIGIBILITY FOR ADMISSION

Candidates who have passed the Two-Year Pre-University Course of Karnataka State in in science stream any discipline with mathematics at plus two level or its equivalent (viz.,

10+2/HSE of other state or central government boards, CBSE, ICSE, NIOS etc.) are eligible for admission into this program.

4. LATERAL ENTRY

4.1 The students who has passed one year – Computer Application/ Artificial Intelligence Diploma/Certificate programmes in Computer Application/ Artificial Intelligence /Skill Enhancement programmes in Computer Application/ Artificial Intelligence of Recognized bodies (Regular/Distance/Open University mode) after Plus two /PUC /Equivalent will be allowed admission to the third semester B.Sc. Artificial Intelligence and Machine Learning.

4.2 The students who has passed Two year – Computer Application/ Artificial Intelligence Diploma/Certificate programmes in Computer Application/ Artificial Intelligence /Skill Enhancement programmes in Computer Application/ Artificial Intelligence of Recognized bodies (Regular/Distance/Open University mode) after Plus two /PUC /Equivalent will be allowed admission to the fifth semester B.Sc. Artificial Intelligence and Machine Learning.

4.3 All compulsory subjects (Languages, Environmental studies, Constitution of India etc.) as required by UGC should be successfully completed in a bridge course if the student has not undergone the prescribed subjects in the diploma/Certificate Course.

5. FEATURES OF CHOICE BASED CREDIT SYSTEM SCHEME

Each course shall carry certain number of credits. Credits normally represent the weightage of a course and are a function of teaching, learning and evaluation strategies such as the number of contact hours, the course content, teaching methodology, learning expectations, maximum marks etc. In the proposed programs, generally one hour of instructions per week in a semester is assigned one credit. In terms of evaluation, one credit is generally equivalent to 25 marks in a semester. Thus a 3 or 4 credits course will be assessed for 100 marks, 2 credits courses are assessed for 50 marks and one credit course will be assessed for 25 marks. What matters for the calculation of Semester Grade Point Average (SGPA) or the Cumulative Grade Point Average (CGPA) is the percentage of marks secured in a course and the credits assigned to that course.

On this basis, generally, a three-year (six-semester) undergraduate program will have around 140 credits, and a four-year (eight-semester) honors degree program will have around 180 credits and a five-year (ten semester) master's degree programme will have 220 credits.

5.1 DURATION OF PROGRAMMES, CREDITS REQIUREMENTS AND OPTIONS

The undergraduate degree should be of either a three- or four-year duration, with multiple entry and exit options within this period, The four years multi-disciplinary Bachelor's programme is the preferred option as it allows the opportunity to experience the full range of holistic and multi-disciplinary education with a focus on major and minor subjects as per the student's preference. The four-year programme may also lead to a degree with Research, if the student completes a rigorous research project in the major area(s) of study

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The undergraduate programmes shall extend over four academic years (Eight Semesters) with multiple entry and exit options. The students can exit after the completion of one academic year (Two semesters) with the Certificate in a discipline or a field; Diploma after the study of two academic years (Four Semesters) and Regular Bachelor Degree after the completion of three academic years (Six Semesters). The successful completion of Four Years undergraduate Programme would lead to Bachelor Degrees with Honours in a discipline/subject. Each semester shall consist of at least 16 weeks of study with a minimum of 90 working days (excluding the time spent for the conduct of final examination of each semester).

The candidates shall complete the courses equivalent to minimum credit requirements

Exit with	Min. Credits Requirement*	NSQF Level
Certificate at the Successful Completion of First Year (Two Semesters) of Four Years Multidisciplinary UG Degree Programme	48	5
A Diploma at the Successful Completion of the Second Year (Four Semesters) of Four Years Multidisciplinary UG Degree Programme	96	6
Basic Bachelor Degree at the Successful Completion of the Third Year (Six Semesters) of Four Years Multidisciplinary Undergraduate Degree Programme	140	7
Bachelor Degree with Honors in a **Discipline** at the Successful Completion of the Four Years(Eight Semesters) Multidisciplinary Undergraduate Degree Programme	180	8

Master's Degree Programmes will be of One Academic Year (Two Semesters) for the Four Years Honours Degree holders and it will be of Two Academic Years (Four Semesters) for the three years basic or three years Bachelor's Degree holders.

Two Years Master's Degree Programmes will have exit option at the end of One Academic Year (Two Semesters) with the Post-graduate Diplomas in the respective disciplines/ subjects, provided they complete courses equal to a minimum of 44 credits:

44 Credits after the Bachelor Degree to become eligible for the PG Diploma

88 Credits after the Bachelor Degree to become eligible for the Masters Degree

It is optional to the candidate to exit or not, after two, four and six semesters of the undergraduate programme with Certificate, Diploma and with Regular Bachelor Degree, respectively. He/she will be eligible to rejoin the programme at the exit level to complete either the diploma, degree or the honors degree. Further, all the candidates will be awarded Bachelor degrees on successful completion of three academic years (Six Semesters) of the undergraduate programmes.

A student will be allowed to enter/re-enter only at the Odd Semester and can only exit after the Even Semester. Re-entry at various levels as lateral entrants in academic programmes should be based on the earned credits and proficiency test records.

The students shall be required to earn at least fifty per cent of the credits from the Higher Education Institution (HEI) awarding the degree or diploma or certificate: Provided further that, the student shall be required to earn the required number of credits in the core subject area necessary for the award of the degree or Diploma or Certificate, as specified by the degree awarding HEI, in which the student is enrolled.

A candidate who successfully completes a three year Bachelor's degree, with a minimum CGPA of 7.5 and wishes to pursue the fourth year of the undergraduate programme by opting a research project, shall be allowed to continue the programme with Research to obtain the Bachelor's degree with honors by research, while other candidates may continue their studies in the fourth year of the undergraduate programme with or without a research project along with other courses as prescribed for the programme to complete their Bachelor's degree with honors.

Candidates who successfully complete their four years Bachelor's degree with honors, either by research or coursework with research component and a suitable grade are eligible to enter the 'Doctoral (Ph.D.) Programme' in a relevant discipline or to enter the 'Two Semester Master's Degree programme".

Candidates, who wish to complete the undergraduate and the postgraduate programmes faster, may do so by completing the different courses equal to the required number of credits and fulfilling all other requirements in N-1 semesters (where N is the number of semesters of an undergraduate/ postgraduate programme). This facility is available for the programmes with a minimum duration of three years or six semesters. For example, a candidate may obtain his/her Six Semesters Bachelor's degree, after successfully completing five semesters of the programme, provided he/she has completed courses equal to the required/ prescribed number of credits and fulfills all other requirements for awarding the degree. Likewise, a candidate may obtain his/her Eight Semesters Bachelor's degree with honors, after successfully completing seven semesters of the programme, provided he/she has completed courses equal to the required number of Credits and fulfills all other requirements for awarding the Bachelor's degree with honors.

Similarly, candidates may complete both the undergraduate and the postgraduate programmes in slow track. They may pursue the three years or six semester programmes in 4 to 5 years (8 to 10 semesters) and four years or eight semester programmes in 5 to 6 years (10 to 12 semesters). As a result, the higher education institutions have to admit candidates not only for programmes, but also for subjects or courses. But the new admissions are generally made in the beginning of an academic year or the beginning of odd semesters.

5.2 NATIONAL SKILLS QUALIFICATIONS FRAMEWORK

The National Skills Qualifications Framework (NSQF) is a competency-based framework that organizes qualifications according to a series of knowledge, skills and aptitude. The NSQF levels, graded from one to ten, are defined in terms of learning outcomes which the learner must possess regardless of whether they are obtained through formal, non-formal or informal learning. National Occupational Standards (NOS) are statements of the skills; knowledge and understanding needed for effective performance in a job role and are expressed as outcomes of competent performance. They list down what an individual performing that task should know and also are able to do. These standards can form the requirements. Just as each job role may require the performance of a number of tasks, the combination of NOSs corresponding to these tasks form the Qualification Pack (QP) for that job role. The NOSs and QPs for each job role corresponding to each level of the NSQF are being formulated by the respective Sector Skill Councils (SSCs) set up by National Skill

Development Corporation (NSDC) with industry leadership. The curriculum which is based on NOSs and QPs would thus automatically comply with NSQF.

General Education has to be synchronized/ aligned with skill and Vocational Education as per National Skills Qualifications Framework. The level descriptors are given below as described in UGC Guidelines on National Skills Qualifications Framework. The curriculum should be designed in a manner that at the end of year-1, year-2 and year-3, students are able to meet below mentioned level descriptors for level 5, 6 and 7 of NSQF, respectively: The progressive curriculum proposed shall position knowledge and skills required on the continuum of novice problem solvers (at entry level of the program) to expert problem solvers (by the time of graduation):

At the end of first year–Ability to solve well defined problems.

At the end of second year– Ability to solve broadly defined problems.
At the end of third year–Ability to solve complex problems that are ill-structured requiring multi-disciplinary skills to solve them.
During fourth year-Experience of workplace problem solving in the form of internship or research experience preparing for higher education or entrepreneurship experience.

6 ACADEMIC BANK OF CREDITS (ABC)

The Academic Bank of Credits (ABC), a national-level facility will promote the flexibility of the curriculum framework and inter-disciplinary/multi-disciplinary academic mobility of students across the Higher Education Institutions (HEIs) in the country with appropriate "credit transfer" mechanism. It is a mechanism to facilitate the students to choose their own learning path to attain a Degree/Diploma/Certificate, working on the principle of multiple entries and exit as well as anytime, anywhere, and any level of learning. ABC will enable the integration of multiple disciplines of higher learning leading to the desired learning outcomes including increased creativity, innovation, higher order thinking skills and critical analysis. ABC will provide significant autonomy to the students by providing an extensive choice of courses for a programme of study, flexibility in curriculum, novel and engaging course options across a number of higher education disciplines/institutions.
The multiple entry and exit options for students is facilitated at the undergraduate and Master's levels. It would facilitate credit accumulation through the facility created by the ABC scheme in the "Academic Bank Account" opened for students across the country to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs. The ABC allows for credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/ diploma/degree by the authorized HEIs. Upon collecting a certificate, diploma or degree, all the credits earned till then, in respect of that certificate, diploma or degree, shall stand debited and deleted from the account concerned. HEIs offering programmes with the multiple entry and exit system need to register in the ABC to enable acceptance of multidisciplinary courses, credit transfer, and credit acceptance.

The validity of credits earned will be for a maximum period of seven years or as specified by the Academic Bank of Credits (ABC). The procedure for depositing credit earned, its shelf life, redemption of credits, would be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) Regulations, 2021.

Study Webs of Active Learning for Young Aspiring Minds (SWAYAM :) is India's national Massive Open Online Course (MOOC) platform (www.swayam.gov.in), designed to achieve the three cardinal principles of India's Education Policy: access, equity, and quality. The University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulations, 2021 have been notified in the Gazette of India, which now facilitates an institution to allow up to 40 per cent of the total courses being offered in a particular programme in a semester through the online learning courses offered through the SWAYAM platform. Universities with approval of the competent authority may adopt SWAYAM Courses for the benefit of the students. A student will have the option to earn credit by completing quality-assured MOOC programmes offered on the SWAYAM portal or any other online educational platform approved by the UGC/ the regulatory body from time to time

7. APPLICATION AND APPROVAL

There will be an application form in the prescribed format that has to be filled by the candidate. The Application will be scrutinized by the university with essential supporting documents prescribed by the University and will give the approval regarding the confirmation of admission.

8. ADMISSION PROCEDURE

8.1. During the time of admission the candidate must submit all the necessary documents in original that support the claim made in the application form.

8.2. The candidates will get the admissions only after getting approval regarding the eligibility of the certificates, as directed by the University guidelines.

8.3. All the decisions taken by the University of Mysore with regard to the course or any matter that is not mentioned over here, is up to the University and all the candidates are liable to follow those decisions.

9. SCHEME OF INSTRUCTION

9.1 Regarding the scheme of instructions, each course offered may have three components- Lecture (L), Tutorial (T) and Practical (P). Lectures are given by the faculties (Regular and Visiting) appointed by the institution both online and offline in blended learning mode. Tutorial session consists of group discussion/self-study /desk work/seminar presentation and other effective methods. Practical or Skill component consist of the applications of the theory content that has to be given either in lab, skill training centres or industry.

9.2 The medium of instruction shall be in English or Kannada as decided by the Board of Studies (BOS). However, the students have to write the exam in English only.

9.3 Credits: One hour session of lecture per week amount to one credit. Two-hour session of tutorial or practical per week amounts to one credit. For the purpose of a teacher, one hour of lecture session, one hour of tutorial session and one hour of practical session are all equal to one hour of workload.

10. BLENDED MODES (BL) AS A NEW MODE OF TEACHING-LEARNING

Blended learning (BL) mode is to be used to help learners develop 21st century skills along with the effective learning and skill development related to the subject-domains. Every institute should strive to be a model institute to demonstrate a successful implementation of BL in the higher education of our country.

UGC suggests implementing Blended Mode (BL) as a new mode of teaching-learning in higher education. BL is not a mere mix of online and face-to-face mode, but it refers to a well-planned combination of meaningful activities in both the modes. The blend demands consideration of several factors, mainly focusing on learning outcomes and the learner centred instructional environment.

Implementing BL requires a systematic, planned instructional process. An effective teaching learning process in a blended environment calls for understanding and skills of using appropriate pedagogies with suitable technologies. The UGC Concept Note provides guidelines for implementation of BL.

Pedagogies for Online and Face-to-face Modes

Learner-centred teaching-learning activities include several cognitive processes which enable learners to be communicative, confident, creative and cooperative. Learners in BL environments are not visualised as passive learners, but active learners generating ideas, assimilating knowledge individually and in teams. Once learning resources are provided on an online platform, students sitting in the classroom need not again listen to the instructor. The time, then, can be used for engaging them in activities. Even their online time can be used innovatively for making online sessions more effective and interesting. There are a few learning processes for both online and face-to-face mode.

Higher education learners are adult learners who come with their own world of experience, previous knowledge gained at schooling level and previous years of education, exposure to other sources of knowledge, etc. Even pre-session resources suggested by teachers help them some knowledge, information. Lecturing of teacher assuming the learners are empty boxes is no more a preferred pedagogy. Learners, instead, can contribute by sharing their knowledge, ideas, and views, either in the classroom or else on online platforms.

BL mode will provide this opportunity to learners to a great extent. Resources can be uploaded and external links can be posted on Learning Management systems prior to classroom sessions. These Out-of-class resources prove useful at least for acquiring information. Once the students' study through the resources, classroom time can be utilized fruitfully in discussions. Online platforms such as discussion forums, shared documents, blogs, etc. may be used to help them share their ideas and knowledge on a common platform.

Innovative trends in Evaluation and Assessment

Out-of-box thinking about summative as well as formative evaluation is expected from the teacher implementing BL mode. The following paragraphs throw light on a few innovative strategies. The list is not exhaustive but mentions a few points with the expectation of continuous exploration of such strategies by the teachers.

Summative Evaluation Strategies

Open book examination:

It is a right way to move away from the conventional approach of examination where remembering and reproducing is prime concern. In real functioning beyond formal education, life is all about open book examination. Hence in Higher Education system, we must prepare students for work life by making them acquainted with open book examinations. It will also facilitate better understanding and application of the knowledge with a better potential for its positive impact.

Group examinations even for conventional theory papers:

Such an approach is followed some time for project and also practical lab assessments. But for theory type examinations it is generally not followed. The group examinations once introduced for theory papers can improve the average performance of a class as students would be encouraged to share their knowledge with each other and also help them improve their general understanding.

Spoken / Speaking examinations:

These types different approached can be introduced now with the support of new generation of technologies. They can make examination faster and easier and also can be helpful to students with different abilities

On demand examinations:

In most cases students are forced to write examination in a single go and collectively. However, with advent of new methods which are technology based and also blending of teaching-learning and examinations in new form, it would be a good approach to offer examination on demand to offer more flexibility and student centricity.

Formative Evaluation Strategies e-Portfolio

e-Portfolio is not only a compilation of a few best assignments, activities of a learner throughout the programme, but his/her reflections about the assignments, experience and challenges faced during the process of working on these assignments, overall approach, attitude, philosophy towards life as a learner and also his/her academic resume. e-Portfolio is a comprehensive tool which becomes a mirror to a learner for the world.

Creative Products

Innovative Pedagogies and relevant ICT tools enable learners to come out with creative products as an individual or group learning activities. These products are learning experiences in the beginning, but learners should always be given corrective feedback about their outputs. Once feedback is sought, learners need to be given chance to improve on their products and then can be considered for formative evaluation. E.g., preliminary concept-map can be revised after discussion of the topic, summarization and feedback. Revised concept- map can be assessed.

One creative/collaborative activity may then be led towards another product which can be an assessment activity. E.g., Group or individual presentations by self-learning would be a learning activity and not an assessment activity. Once teacher provided corrective feedback during such presentations, learners can be expected to revise the same presentations, add a small write-up/info graph/video to it and submit as an assignment. Creative assignments such as digital stories, Cartoon

strips, drama scripts, e-Newsletter, e- Magazine, Recorded interviews of stakeholders, Case studies, etc. can be used for formative assessment.

Classroom/Online Quizzes

Though paper-pencil tests, over-use of question-answers may be discouraged for formative assessments, a few ICT tools for quizzes and games can be used eventually for formative assessment.

Use of AI tools for Proctoring as well as assessments:

During the Covid time, many exams were forced to be conducted in an online mode. These were supported by variety of tools which came into being in recent times and were based on proctoring through Artificial Intelligence tools. However, AI as technology can be used for many more assessments like, attention levels, speed of learning, level of learning etc. Hence new tools should be experimented with for examinations and assessments.

11. INDUSTRIAL EXPOSURE TRAINING

11.1 In the fourth and sixth semester every student may undergo project – Phase I and project Phase II respectively to get the exposure of the respective industry or training and skill centres conveniently arranged during the course of in these semesters. The head of the institution and the authorized person of the training and skill centre shall issue a certificate to the effect that the student has satisfactorily undergone the industrial training for the prescribed period.

11.2 Project report will be evaluated by the University in the form of Training report, Log-book and Viva- voce.

11.3 Evaluation of the both these Projects is for 100 marks and that has been divided into three components.

a) C1 -20 Marks (Log book & Training Report).
b) C2-20 Marks (Viva-voce conducted Internal Examiner).
c) C3- 60 Marks (Viva-voce conducted by External Examiners).

11.4. The candidate who wishes to continue the course in fourth year also must under go two Research oriented Projects Phase I and Phase II in seventh and eighth semester respectively.

12. SKILL ENHANCEMENT PROGRAMME

12.1 In all the specified semesters there will be a Skill Enhancement Programme that is incorporated in the curriculum, with the aim of achieving appropriate platform and domain skill exposure related to each course and demanded by the industry.

12.2 The skill enhancement programs are evaluated by the University /Institute /Accreditation body. An authorized body will issue performance certificates to the students based on their involvements and efficiency. The students also have to submit a detailed report to the Institute. These Skill Enhancement programmes are devised, monitored and evaluated in keeping with the university guidelines.

12.3 The students can undergo Skill enhancement programmes either in the institute or other institutions /skill training centres /industries. The institute shall facilitate the students those who prefer to do skill enhancement programmes from other institutions /skill training centres /industries (across India and abroad), which are willing to associate with our institute signing Mou.

12.4 The students will have to complete their Skill enhancement programmes to get the skills which are indispensable regarding their career advancement.

12.5 Evaluation of the Skill Enhancement Programme is for 50 marks and that has been divided into three components.

a) C1 -10 Marks (Skill Enhancement Certificate).
b) C2 -10 Marks (Skill Enhancement Report evaluated by Internal Examiner).
c) C3- 30 Marks (Viva-voce conducted by Internal and External Examiners).

13. SCHEME OF ASSESSMENT

Total marks for each course shall be based on continuous assessments and semester end examinations. As per the decision taken at the Karnataka State Higher Education Council, it is necessary to have uniform pattern of 40: 60 for IA and Semester End theory examinations respectively and 50:50 for IA and Semester End practical examinations respectively.

Total Marks for each Theory course=100% Continuous assessment (C1) =20%marks Continuous assessment (C2) = 20% marks Semester End Examination (C3) = 60%marks

Total Marks for each Practical/Skill course=100% Continuous assessment (C1) =20%marks Continuous assessment (C2) = 30% marks [including 10% for Record/Work book] Semester End Examination (C3) = 50%marks

13.1 Evaluation process of IA marks shall be as follows.

- The first component (C1) of assessment is for 20% marks. This shall be based on test, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course/s and within 45 working days of semester program
- The second component (C2) of assessment is for 20% marks. This shall be based on test, assignment, seminar, case study, fieldwork, internship/industrial practicum/project work etc. This assessment and score process should be based on completion of remaining 50 percent of syllabus of the courses of the semester.
- During the 17^{th} – 19^{th} week of the semester, a semester end examination shall be conducted by the Institution for each Course. These forms the third and final component of assessment (C3) and the maximum marks for the final component will be 60% for theory and 50% for Practical/Skill Course.
- In case of a student who has failed to attend the C1 or C2 on a scheduled date, it shall be deemed that the student has dropped the test. However, in case of a student who could not take the test on scheduled date due to genuine reasons, such a candidate may

appeal to the Program Coordinator / Principal. The Program Coordinator / Principal in consultation with the concerned teacher shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date fixed by the concerned teacher but before commencement of the concerned semester end examinations.

The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under.

13.1 **Outline for continuous assessment activities for C1 and C2**

Activities	**C1**	**C2**	**Total Marks**
Session Test	10marks	10marks	20
Seminars/ Presentations/ Activity	10marks		10
Case study/ Assignment/Field work/Record or Work Book/Project work etc.		10marks	10
Total	20marks	20marks	40

13.2 **Components of continuous assessment activities for C1and C2**

	C1			C2	
	Max marks	To be reduced to		Max marks	To be reduced to
Session test	20	10		20	10
Assignment		10		Quiz	05
				Project	05
				Role Play	05
				Charts/Models	05
				Case study	05
				Group discussion	05
				Crosswords	05
				Presentation	05
				Review–movie/Book	05
				presentation	05
				e–content preparation	05
				Any two activities from the above list to be conducted, according to the convenience of teacher depending upon the number of students 5x2 =10marks	
Total		20marks		20 marks	

a) For practical/Skill course of full credits, Seminar shall not be compulsory. In its place, marks shall be awarded for Practical Record Maintenance. (The ratio is 50%:50%)
b) Conduct of Seminar, Case study /Assignment, etc. can be either in C1or in C2 component at the convenience of the teacher concerned.
c) The teachers concerned shall conduct test / seminar / case study, etc. The students should be informed about the modalities well in advance.

d) The evaluated courses/assignments of component I (C1) and component II (C2) shall be provided to the candidates and the IA register has to be maintained by the department.
e) The evaluated courses/ assignments of component I (C1) and component II (C2) shall be maintained at the department till the announcement of the results of the examination of the semester concerned.
f) The marks of the internal assessment shall be published on the notice board/website of the College for the information of the students.
g) The Internal assessment marks shall be communicated to the Controller of Examinations at least 10 days before the commencement of the Semester End examination and the Controller of Examinations shall have the access to the records of such periodical assessments.
h) There shall be no minimum in respect of internal assessment marks.
i) Internal assessment marks may be recorded separately. A candidate, who has failed or rejected the result, shall retain the internal assessment marks.

14. SUBJECTIVE REGULATIONS:

14.1Under AECC a candidate has to study English and additionally choose any ONE of the languages namely, Kannada, French, Malayalam and Hindi. And also, candidate has to pursue Environmental studies and Constitution of India under AECC category.

14.2 Change of languages once chosen will not be permitted during the period of the program.

14.3 In the case of foreign nationals, the requirement of an Indian language may be waived by the University of Mysore. In such an eventuality, the University may permit the foreign national student for private study of choice of any one foreign language. Such a student will not be evaluated for C1 and C2 marks. However, for the final grade calculation of 60 marks of C3 will be equated to 100 marks.

15. ATTENDANCE

15.1Only those students who are scoring 75% of attendance shall be permitted to take C3 examination for that course.

15.2 A candidate who does not satisfy the minimum attendance percentage (75%) shall re-join the course unless producing medical certificates and paying required fees by obtaining prior permission from the University if needed.

16. BOARD OF EXAMINERS

16.1 There shall be a board of examiners for each course, constituted by the University for scrutinizing and approving the question paper and scheme of evaluation.

16.2 There will be only a single valuation for all the papers.

17 QUESTION PAPER PATTERN

17.1 Internal Assessment Tests (IAT): The IAT will carry a maximum of 20% weightage (20 marks) of total marks of a course.

17.2 SEMESTER END EXAMINATION (SEE):

The Semester End Examination for all the courses for which students who get registered during the semester shall be conducted. SEE of the course shall be conducted after fulfilling the minimum attendance requirement as per the University norms. The BOS of the University has prepared the SEE framework and the question paper pattern for SEE is presented below for 60 marks.

PATTERN OF QUESTION PAPER

TIME: 2 HOURS MARKS: 60

PART – A

Answer any FIVE out of Eight questions. Each question carries 3 marks. (5x3= 15)

1. ----------

2. ----------

3. ----------

4. ----------

5. ----------

6. ----------

7. ----------

8. ----------

PART – B

Answer any THREE out of Five questions. Each question carries 5 Marks. (3x5 =15)

8. ----------

9. ----------

10. ----------

11. ----------

12. ----------

PART – C

Answer ONE of Two questions. Each question carries 15 Marks (1x15=15)

13. ----------

14. ----------

PART – D

Answer ONE of Two questions. Each question carries 15 Marks (1x15=15)

15. ----------

16. ----------

18. CONDUCT OF EXAMINATIONS

- A candidate shall register for all the courses/papers of a semester for which he/she fulfills the requirements, when he/she appears for the examination of that semester for the first time.
- There shall be Theory and Practical examinations at the end of each semester, ordinarily during November-December for odd semesters and during May-June for even semesters, as prescribed in the Scheme of Examinations.
- Unless otherwise stated in the schemes of examination, practical examinations shall be conducted at the end of each semester. They shall be conducted by two examiners, one internal and one external. The statement of marks sheet of practical examinations shall be sent to the office of the Controller of Examinations by the respective departments immediately after the practical examinations.
- The candidate shall submit the record book for practical examination duly certified by the course teacher and the H.O.D/staff in-charge. It shall be evaluated at the end of the Semester during the practical examination.

19. MINIMUM REQUIREMENTS FOR A PASS:

a) No candidate shall be declared to have passed the Semester Examination as the case may be under each course/paper unless he/she obtains not less than 35% marks in theory examination /practical examination and 40% marks in the aggregate of theory / practical examination and internal assessment put together in each of the courses and 40% marks (including IA) in Project work and viva wherever prescribed.

b) A candidate shall be declared to have passed the program if he/she secures at least 40% of marks or a CGPA of 4.0 (Course Alpha-Sign Grade P) in the aggregate of both internal assessment and semester end examination marks put together in each unit such as theory papers / practical / fieldwork / internship / project work / dissertation / viva-voce, provided the candidate has secured at least 40% of marks in the semester end examinations in each unit.

c) The candidates who pass all the semester examinations in the first attempt only are eligible for ranks, provided they secure at least CGPA of 6.00 (Alpha-Sign Grade B+)

d) A candidate who passes the semester examinations in parts (more than one attempt) is eligible only for a Class, CGPA and Alpha-Sign Grade but not for ranking.

e) The results of the candidates who have passed the last semester examination but not passed the lower semester examinations shall be declared as NCL (Not Completed the Lower

Semester Examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.

f) If a candidate fails in a subject, either in theory or in practical, he/she shall appear for that subject only at any subsequent regular examination, as prescribed for completing the programme. He/she must obtain the minimum marks for a pass in that subject (theory and practical, separately) as stated above.

g) Candidates who fail in lower semester examinations may go to the higher semesters and take the lower semester examinations

20. CLASSIFICATION OF SUCCESSFUL CANDIDATES

An alpha-sign grade, the eight-point grading system, as described below may be adopted. The declaration of result is based on the Semester Grade Point Average (SGPA) earned towards the end of each semester or the Cumulative Grade Point Average (CGPA) earned towards the completion of all the eight semesters of the programme and the corresponding overall alpha-sign grades. If some candidates exit at the completion of first, second or third year of the four years Undergraduate Programmes, with Certificate, Diploma or the Basic Degree, respectively, then the results of successful candidates at the end of second, fourth or sixth semesters shall also be classified on the basis of the Cumulative Grade Point Average (CGPA) obtained in the two, four, six or eight semesters, respectively, for the award of

- Certificate in Arts/ Science/ Commerce
- Diploma in Arts/ Science/ Commerce
- Bachelor's Degree in Arts/ Science/ Commerce
- Bachelor's Degree with Honors in a Discipline/Subject

In addition to the above, successful candidates at the end of tenth semester of the integrated Master's Degree Programmes, shall also be classified on the basis of CGPA obtained in the ten semesters of the Programmes. Likewise, the successful candidates of one year or two semester's Master's Degree Programmes are also classified on the basis of CGPA of two semesters of the Master's Degree Programmes.

Final Result / Grades Description

Semester GPA/ Program CGPA	**Alpha-Sign / Letter Grade**	**Semester/Program % of Marks**	**Result / Class Description**
9.00-10.00	**O** (Outstanding)	90.0-100	Outstanding
8.00-<9.00	**A+** (Excellent)	80.0-<90.0	First Class Exemplary
7.00-<8.00	**A** (Very Good)	70.0-<80.0	First Class Distinction
6.00-<7.00	**B+** (Good)	60.0-<70.0	First Class
5.50-<6.00	**B** (Above Average)	55.0-<60.0	High Second Class

5.00-<5.50	**C** (Average)	50.0-<55.0	Second Class
4.00-<5.00	**P** (Pass)	40.0-<50.0	**Pass Class**
Below 4.00	**F** (Fail)	Below 40	Fail/Reappear
Ab (Absent)	**-**	Absent	-

21. REJECTION OF RESULTS:

- A candidate may be permitted to reject result of the whole examination of any semester. Rejection of result course/paper wise or subject wise shall not be permitted.
- The candidate who has rejected the result shall appear for the immediately following examination.
- The rejection shall be exercised only once in each semester and the rejection once exercised shall not be revoked.
- Application for rejection of results along with the payment of the prescribed fee shall be submitted to the Registrar (Evaluation) through the College of study together with the original statement of marks within 30 days from the date of publication of the result.
- A candidate who rejects the result is eligible for only SGPA/CGPA or Class and not for ranking.

22.IMPROVEMENT OF RESULTS

- A candidate who has passed in all the papers of a semester may be permitted to improve the results by reappearing for the whole examination of that semester.
- The reappearance may be permitted during the period of N+2 years (where N refers to the duration of the programme) without restricting it to the subsequent examination.
- The student may be permitted to apply for improvement examination 45 days in advance of the pertinent semester examination whenever held.
- If a candidate passes in all the subjects in reappearance, higher of the two aggregate marks secured by the candidate shall be awarded for that semester. In case the candidate fails in the reappearance, candidate shall retain the earlier result.
- A candidate who has appeared for improvement examination is eligible for class/CGPA only and not for ranking.
- Internal assessment (IA) marks shall be shown separately. A candidate who wants to improve the result or who, having failed, takes the examination again or who has appeared for improvement shall retain the IA marks already obtained.
- A candidate who fails in any of the semester examinations may be permitted to take the examinations again at a subsequent appearance as per the syllabus and scheme of examination in vogue at the time the candidate took the examination for the first time. This facility shall be limited to the following two years.

23. SUBJECTS OF STUDY

23.1 **Ability Enhancement Courses**

Ability Enhancement (AE) Courses can be divided into two categories:

a) AE Compulsory Courses (AECC): The universities may have common curriculum forthese papers. There may be one paper each at least in the first four semesters viz.

(i) Environmental Studies and (ii) Constitution of India.

(ii) In addition to these, two languages shall be studied in the first four semesters of theUndergraduate Programmes.

b) LANGUAGES:

- Two languages are to be studied out of which one shall be English and the other shallbe either Kannada or an Indian Language or other foreign language:

- The language syllabus and curriculum is prepared by the institution and not mandatory to follow university syllabus and curriculum of the university as required by specialized skill curriculum of respective courses

Skill Enhancement Courses (SEC):

- The colleges can offer from a common pool of papers listed by KSHEC/ National Regulatory Bodies such as UGC or GEC/ NHERC or the universities may frame some papers, in addition to the list suggested.

24. TRANSFERS OF ADMISSION:

Transfer of admissions is permissible only for odd semesters for students of other universities and within the University.

24.1. **Conditions for transfer of admission of students within the University.**

A His/her transfer admission shall be within the intake permitted to the college.

B Availability of same combination of subjects studied in the previous college.

C He/she shall fulfill the attendance requirements as per the University Regulation.

D He/she shall complete the programme as per the regulation governing the maximum duration of completing the programme.

24.2. **Conditions for transfer admission of students of other Universities.**

a) A Candidate migrating from any other University may be permitted to join odd semester of the degree programme provided he/she has passed all the subjects of previous semesters / years as the case may be. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of the University.
b) His/her transfer admission shall be within the intake permitted to the college.
c) He/she shall fulfill the attendance requirements as per the University Regulation.
d) The candidate who is migrating from other Universities is eligible for overall SGPA/CGPA or Class and not for ranking.

e) He/She shall complete the programme as per the regulation governing the maximum duration of completing the programme as per this regulation

i. **Any other regulations not mentioned above shall be resolved by the Vice –Chancellor in consultation with the designated authorities of the University of Mysore, which shall be final and firm.**
ii. **Wherever the regulation is silent, the provisions of university regulations are applicable.**

B.Sc. (Hons). (Artificial Intelligence and Machine Learning)

Proposed Scheme of Teaching & Evaluation for B.Sc. (Hons) II and III Year with Artificial Intelligence and Machine Learning as Core subject.

Semester III									
Sl. No	**Course Code**	**Title of the Course**	**SEE**		**CIE**		**L+T+P**	**Total Marks**	**Credits**
			Theory	**Practical**	**C1**	**C2**			
1	**BAM17**	Introduction to A I	60	-	20	20	4+0+0	100	**4**
2	**BAM18**	Python Programming	60	-	20	20	4+0+0	100	**4**
3	**BAM19**	Data Structure and Computer Algorithm	60	-	20	20	3+1+0	100	**4**
4	**BAM20**	Elective- I – Computer Architecture/ Introduction to Multimedia Technology/Office Automation	-	50	20	30	0+1+6	100	**4**
5	**BAM21**	Lab 3: Python Programming	-	50	20	30	0+1+6	100	**4**
6	**SEC 3**	Skill Enhancement Course- Internet of Things and Robotics	-	30	10	10	0+2+2	50	**2**
Total Credit									**22**

B.Sc. (Hons) (Artificial Intelligence and Machine Learning)

Semester IV									
Sl. No	**Course Code**	**Title of the Course**	**SEE**		**CIE**		**L+T+P**	**Total Marks**	**Credits**
			Theory	**Practical**	**C1**	**C2**			
1	**BAM22**	Introduction to M L	60	-	20	20	4+0+0	100	**4**
2	**BAM23**	Fussy Logic and Neural Networks	60	-	20	20	4+0+0	100	**4**
3	**BAM24**	R- Programming	60	-	20	20	2+1+0	100	**3**
4	**BAM25**	Design and Analysis of Algorithm	60	-	20	20	3+1+0	100	**4**
5	**BAM26**	Lab 4: R- Programming	-	50	20	30	0+1+4	100	**3**
6	**BAM27**	Lab 5: Machine Learning -I	-	50	20	30	0+1+4	100	**3**
7	**SEC4**	Capstone -Project Work-Phase I	-	60	20	20	0+1+4	100	**3**
Total Credit									**24**

B.Sc. (Hons) (Artificial Intelligence and Machine Learning)

Semester V									
Sl. No	**Course Code**	**Title of the Course**	**SEE**		**CIE**		**L+T+P**	**Total Marks**	**Credits**
			Theory	**Practical**	**C1**	**C2**			
1	**BAM28**	Machine Learning Techniques	60	-	20	20	4+0+0	100	**4**
2	**BAM29**	Artificial Intelligence and Knowledge Representation	60	-	20	20	3+1+0	100	**4**
3	**BAM30**	Principles of Deep Learning	60	-	20	20	3+0+0	100	**3**
4	**BAM31**	Mobile Application Development	-	50	20	30	0+1+4	100	**3**
5	**BAM32**	Elective -II Business Data Analytics/ Ethics and social implications of AI/ Operating Systems	60	-	20	20	2+1+0	100	**3**
6	**BAM33**	Lab6: Machine Learning Lab-II	-	50	20	30	0+1+4	100	**3**
7	**SEC5**	Skill Enhancement Course- Ethical Hacking	-	30	10	10	0+2+2	50	**2**
Total Credit									**22**

B.Sc. (Hons) (Artificial Intelligence and Machine Learning)

Semester VI									
Sl. No	**Course Code**	**Title of the Course**	**SEE**		**CIE**		**L+T+P**	**Total Marks**	**Credits**
			Theory	**Practical**	**C1**	**C2**			
1	**BAM34**	Pattern Recognition	60	-	20	20	4+0+0	100	**4**
2	**BAM35**	Natural Language Processing	-	50	20	30	0+2+6	100	**4**
3	**BAM36**	Elective III -Cyber Security/ Soft Computing/ Business Intelligence	60	-	20	20	4+0+0	100	**4**
4	**BAM37**	Project Work Lab	-	50	20	30	0+1+6	100	**4**
5	**BAM38**	Data Base Management System	-	50	20	30	0+1+6	100	**4**
6	**BAM39**	Capstone- Project work – Phase II	-	60	20	20	0+1+6	100	**4**
Total Credit									**24**

B.Sc. (Hons) (Artificial Intelligence and Machine Learning)

Semester VII									
Sl. No	**Course Code**	**Title of the Course**	**SEE**		**CIE**		**L+T+P**	**Total Marks**	**Credits**
			Theory	**Practical**	**C1**	**C2**			
1	**BAM40**	Image Analytics	60	-	20	20	4+0+0	100	**4**
2	**BAM41**	Cloud Computing	-	50	20	30	0+1+6	100	**4**
3	**BAM42**	Research Methodology	60	-	20	20	4+0+0	100	**4**
4	**BAM43**	Elective IV- Data Visualization/ Information Retrieval/ Cyber Threat Intelligence	60	-	20	20	4+0+0	100	**4**
5	**BAM44**	Research Project – Phase I	-	50	20	30	0+2+6	100	**4**
Total Credit									**20**

Semester VIII									
Sl. No	**Course Code**	**Title of the Course**	**SEE**		**CIE**		**L+T+P**	**Total Marks**	**Credits**
			Theory	**Practical**	**C1**	**C2**			
1	**BAM45**	Software Engineering	60	-	20	20	3+0+0	100	**4**
2	**BAM46**	Operations Research	60	-	20	20	3+0+0	100	**4**
3	**BAM47**	Advanced A I and Applications	60	-	20	20	4+0+0	100	**4**
4	**BAM48**	Research Project- Phase II	-	50	20	30	0+1+6	100	**4**
5	**BAM49**	Human Machine Interaction	60	-	20	20	4+0+0	100	**4**
5	**BAM50**	Quantitative Aptitude	-	30	10	10	0+2+2	50	**2**
Total Credit									**22**

B.Sc. (Hons). Artificial Intelligence and Machine learning

2023-24 Syllabus (Detailed)

As per the NEP 2020

PROGRAMME OUTCOMES

a) Showed excellent subject knowledge and completed the assigned responsibilities effectively and efficiently in line with the desired quality standards.
b) To identify, formulate, analyze, and solve complex problems and arrive at authenticated conclusions, use analytical and critical thinking.
c) Establishing and developing evidence-based solutions for complex issues with definite demands while taking public health, safety, cultural, societal, and environmental concerns into consideration is significant.
d) Develop your ability to listen, read, communicate effectively, and articulate complex ideas while taking into account the abilities and needs of various audiences.
e) Possess the traits of a good entrepreneur and present novel ideas to launch new business ventures.
f) Acquire the qualities of a good leader and engage in efficient decision making.
g) Graduates will possess the skills necessary to take on any responsibility as an individual or as a member of multidisciplinary teams, as well as the ability to lead a team.
h) Perform as socially responsible individual with ethical ideals and accountable to ethically validate any activities or decisions before proceeding and actively contribute to the societal concerns.
i) Recognize and fulfil their own educational needs in a changing world in ways that will keep them competent and enable them to advance knowledge.
j) Apply management principles to one's own work to manage projects and in a multidisciplinary environment, demonstrating knowledge of and understanding of these principles.

SEMESTER III

Semester III
Introduction to AI

Course Outcomes:

- Prepare and motivate students for doing research in Computer Science and Artificial Intelligence.
- Hands on experience on doing experiment for solving real life problems using advanced programming languages.
- Develop the skill set for industry ready professionals to join the Information Technology field.

UNIT I:

Introduction –Definition – Technologies based on Artificial Intelligence – Characteristics of Intelligent Agents–uses of AI – need for artificial intelligence- How AI will change the future - Applications of AI

UNIT II:

Knowledge Representation - Knowledge Management, Types of Knowledge, Knowledge representation-bases and structures - First Order logic, Unification algorithm, Frames, Conceptual Dependency, Scripts, Semantic network

UNIT III:

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics –Local Search Algorithms and Optimization Problems -Searching with Partial observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning.

UNIT IV:

Software Agents Architecture for Intelligent Agents – Agent communication -AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving

Reference Books:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
3. Kevin Knight, Elaine Rich – "Artificial Intelligence" ,3rd Edn, Pearson, Chennai.
4. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.
5. Artificial Intelligence: A Modern Approach, 4th Edition, Stuart Russell, peter

Semester III Python Programming

Course Outcomes

- Demonstrate the concepts of control structures in Python.
- Implement Python programs using functions and strings.
- Implement methods to create and manipulate lists, tuples and dictionaries.

UNIT I:

Basics of Python - Variables -identifiers and key words - Basic Syntax-Standard Data Types – Relational Operators -Logical Operators - -Comparison Operators, Boolean Operators, Elements of Flow Control, Program Execution, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods.

UNIT II:

Function-definition - Passing parameters to a Function - Built-in functions- Variable Number of Arguments -scope – Type Conversion-Type Coercion-Passing Functions to a Function – Mapping Functions in a dictionary – Lambda - Modules. List - list methods - list loop–mutability–aliasing-cloning lists - list parameters. Tuple assignment, tuple as return value -Sets–Dictionaries.

UNIT III:

Object Oriented Programming and Debugging- object Oriented Concepts and Terminology Custom Classes - Attributes and Methods –inheritance and Polymorphism Debugging- Syntax Errors - Debugging Runtime errors - Testing - Unit Testing – Profiling.

UNIT IV:

Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories.

Reference books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, WileyIndia Pvt Ltd.
2. Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson EducationIndia, 2015.
3. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures andAlgorithms in Python”, 1st Edition, Wiley India Pvt Ltd, 2016.
4. ReemaThareja, “Python Programming using problem solving approach”, OxfordUniversity press, 2017.
5. A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
6. Martin C. Brown, ―PYTHON: The Complete Reference, McGraw-Hill, 2001

Semester III

Data structure and Computer Algorithms

Course Outcomes:

- Define the concept of Data structure and list the various classifications of data structures.
- Illustrate the various file organizations like Sequential, Random and Linked organizations.
- Discover the real time applications of the various data structures
- Design algorithms for various sorting and searching techniques

UNIT I:

Introduction and Overview – Introduction – Basic Terminology; Elementary Data Organization – Data Structure Operations – Complexity of Algorithms –Linked Lists: Concept ofstatic versus dynamic data structures, implementation of linked lists using pointers, operations on linked lists: insertion, deletion and traversing. Doubly linked listsand circular linked lists, applications of linked lists.

UNIT II:

Stacks and Queues: FIFO and LIFO data structures – stacks using (i) pointers and (ii)arrays. Queues using (i) pointers and (ii) arrays, applications, polish notation.

UNIT III:

Trees: Concept of linear versus non-linear data structures, various types of trees – binary, binary search trees. Creating a binary search tree, traversing a binary tree (in-order, pre-order and post-order), operations on a tree – insertion, deletion and processing, expression trees, implementation using pointers, applications.

UNIT IV:

Algorithms: Introduction: What is an Algorithm? –Algorithm Specification Performance Analysis – Divide and Conquer: General method –Binary Search Finding the maximum and minimum – Merge Sort – Quick Sort –Selection – Strassen‘s Matrix Multiplication.

Reference Books

1. A. K.Sharma, Data Structures Using C, Pearson, Second edition,2011
2 Nair A.S., Makhalekshmi, Data Structures in C, PHI, Third edition 2011.
3. Data Structures – Seymour Lipschutz –Tata McGraw-Hill -2006
4. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni, Galgotia Publications Pvt. Ltd, New Delhi.
5. Data Structure and Algorithm Analysis in C – Mark Allen Weiss – SecondEdition, AddisonWesley publishing company, 1997.

Semester III
Elective 1: computer Architecture

Course Outcomes

- Understand the Architecture of computers
- To understand different types of processors
- To aware the internal processing of computer

UNIT I:

Functional units of a PC; basic operational concepts; memory address, word, instruction set, programs, assembly language instructions; CPU registers; addressing modes, instruction format, system buses, instruction cycle, memory, example-organization of 8085 computer; encoding of information, unsigned numbers, signed numbers, operations, Booth's algorithm

UNIT II:

Processing unit: Specifying a CPU, design of a simple CPU, fetching instructions, decoding and executing instructions, branching, design of a simple ALU, design of control unit, multiple buses in CPU, Micro-program, micro sequencer, micro subroutine, microinstruction format, design and implementation of a simple micro-sequencer; micro-programmed control and hardwired control, Pipelining and Parallel processing, Pentium microprocessor.

UNIT III:

Memory: memory hierarchy, speed, size, cost; RAM, ROM, internal chip organization; cache memory, operations in cache memory, hit ratio, multilevel organization of cache memory; virtual memory,page fault, TLB, segmentation, memory protection, multiple module memories, memory interleaving.

UNIT IV:

Input Output operations: Accessing I/O devices; Asynchronous data transfers, handshaking, programmed I/O, polling, interrupts: types of interrupts, processing interrupts, priority, interrupt hardware, ISR, daisy chaining; Direct memory access, DMA controller, transfer modes, I/O processors, serial communication, UART, standards: RS-232, USB.

Reference Books:

1. Carpinelli, John D., Computer systems Organization & Architecture, Pearson Education
2. Carl Hamacher, Vranesic, Zaky, Computer Organization 4/e, McGraw-Hill
3. SRD Group, Computer Organization, McGrawhill, Tenth edition

Semester III
Skill enhancement course
Internet of things and robotics

Course Outcomes:

- Understanding the IoT Fundamentals and architecture modelling
- Understand general concepts of Internet of Things (IoT)
- Recognize various devices, sensors and applications

UNIT I:

Internet of things: Overview, Definitions and Characteristics of IoT, IoT Architectural View, Physical Design of IOT, Logical Design of IoT- IoT Functional blocks, IoT communicationmodels, IoT Enabling Technologies, IoT Levels & Deployment Templates.

UNIT II:

Writing Code: building a program and deploying to a device, writing to Actuators, Blinking Led, Reading from Sensors, Light Switch, Voltage Reader, Device as HTTPClient, HTTP, Push Versus Pull

UNIT III:

Pachube, Netduino, Sending HTTP Requests—the Simple Way, Sending HTTP Requests—the Efficient Way

UNIT IV:

Introduction to Robotics classification- Components, Characteristics, Applications. Robotics Kinematics: Position Analysis, Robots as Mechanisms, Matrix Representation, Transformation Matrices.

Reference books:

1. Adrian McEwen and Hakim Cassimally, ―Designing the Internet of Things‖,John Wiley & Sons, 2013.
2. CunoPfister, ―Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Maker Media, 2011.
3. Rob Barton, Gonzalo Salgueiro, David Hanes, ―IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things‖, Cisco Press, 2017.
4. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015.

SEMESTER IV

Semester IV
Introduction to ML

Course Outcomes

- Implement different classification algorithms used in machine learning.
- Implement clustering and component analysis techniques.

UNIT I:
Introduction to Machine Learning Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, bia, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods

UNIT II:
Neural Networks, threshold logic units, linear machines, networks of threshold learning units, Training of feed forward networks by back propagations, neural networks vs. knowledge-based systems

UNIT III:
Statistical Learning, background and general method, learning belief networks, nearest neighbor. Decision-trees, supervised learning of uni-variance decision trees, network equivalent of decision trees, over fitting and evaluation.

UNIT IV:
Logic Programming Inductive Logic Programming, notation and definitions, introducing recursive programs, Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

Reference Books:

1. Introduction to Machine learning, Ethem Alpaydin, Third Edition, MIT Press, 2009.
2. Machine learning for dummies, John Paul Muller, Luca Massaron, Weily, 2 nd Edition, 2021.
3.Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller Sarah Guido, O'Reilly
4.Baldi, P., Frasconi, P., Smyth, P. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.

Semester IV
Fuzzy Logic and Neural Networks

Course Outcomes

- To master the various fundamental concepts of fuzzy logic and artificial neural networks.
- To get sufficient knowledge to analyze and design the various intelligent control systems

UNIT-I

Basic concept of fuzzy logic: fuzzy set theory- basic concept of crisp sets and fuzzy sets-complements- union-intersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems

UNIT II

Architecture of neural network-motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functions-Basic learning rules- McCulloch-Pitts neuron-Architecture, algorithm, applications-single layer net for pattern classification- Biases and thresholds, linear separability - Hebb's rule- algorithm -perceptron -Convergence theorem-Delta rule

UNIT III

Application of Fuzzy Logic Systems Fuzzy logic control: Home heating system - liquid level control - aircraft landing- inverted pendulum –fuzzy PID control, Fuzzy based motor control.

UNIT IV

Neural network based on competition: fixed weight competitive nets- Kohonenself organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2

Reference Books:

1. T1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Timothy J. Ross, _Fuzzy Logic with Engineering Applications ', Tata McGraw Hill, 1997.
3. Lawrence Fussett- fundamental of Neural network Prentice Hall, First Edition. Reference Books:

Semester IV

R Programming

Course Outcomes:

- Understand the basics in R programming in terms of constructs, control statements, stringfunctions
- Understand the use of R for Big Data analytics
- Apply R programming for Text processing

UNIT I

Introducing to R 18 Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names.

UNIT-II

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns–Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations–Accessing list components and values – applying functions to lists – recursive lists.

UNIT III

Data Frames- creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements–Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion–Replacement functions – Tools for Composing function code – Math and Simulation in R.

UNIT IV

Classes -S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor –reading and writing files – accessing the internet – String Manipulation Interfacing R 18- Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model –Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

Reference Books

1. Norman Matloff, ―The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, 2011.
2. Jared P. Lander, ―R for Everyone: Advanced Analytics and Graphics, Addison-Wesley Data & Analytics Series, 2013.

Semester IV
Design Analysis and Algorithm

Course Outcomes:

- Explain the importance of algorithm analysis and the notation used
- Apply the various frameworks for analyzing recursive and non-recursive algorithms to find the time complexity
- Illustrate the various algorithm design techniques like divide and conquer, greedy algorithms, brute force and dynamic programming

UNIT I:

Algorithm Analysis: properties of a good algorithm, efficiency considerations, time complexity,

space complexity, Asymptotic notations: Big O notation, best case, worst case, average case, recursive and no-recursive algorithms for binary search.

UNIT II:

Algorithm design techniques-Divide and conquer method: binary search as a divide-and-conquer

algorithm, finding maximum and minimum, Strassen's matrix multiplication Greedy method: Knapsack problem, minimum cost spanning trees, Prim's algorithm

UNIT III:

Dynamic programming: principle of optimality, all pair shortest paths, single source shortestpaths, travelling sales person's problem Back tracking: implicit constraints and explicit constraints, 8 queen's problem, Branch and bound: LC search

UNIT IV:

Standard Algorithms: sorting- quick sort, merge sort, complexity of sorting algorithms, Deterministic and non-deterministic algorithms, NP-hard and NP complete- basic concepts.

Reference Books:

1.AnanyLevitin, Introduction to design and analysis of algorithms, Pearson, Second Edition

2.Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekharan –Computer Algorithms / C++, Second Edition- Universities Press.

Semester IV
Lab IV R - Programming

Course Outcomes

- To expose the student sot the fundamental concepts of R Programming
- Understand the basics in R programming in terms of constructs, control statements, stringfunctions
- Understand the use of R for Big Data analytics K2

List of Programs

1. R Expressions and Data Structures
2. Manipulation of vectors and matrix
3. Operators on Factors in R
4. Data Frames in R
5. Lists and Operators
6. Working with looping statements.
7. Graphs in R
8. 3D plots in R

Semester IV

Lab V: Machine Learning

Course Outcomes:

- Understand the basic concepts and techniques of Machine Learning.
- Explain the regression methods, classification methods, clustering methods.
- Demonstrate Dimensionality reduction Techniques

List of Programs

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use anappropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data setstored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. 6.Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these twoalgorithms and comment on the quality of clustering. You can add Java/Python ML library lasses/API in the program.

7. Write a program to implement k-Nearest Neighbor algorithm to classify the irisdata set.

8. Print both correct and wrong predictions. Java/Python ML library classes can beused for this problem.

9. Implement the non-parametric Locally Weighted Regression algorithm in orderto fit data points.

10. Select appropriate data set for your experiment and draw graph.

Semester IV
Capstone -Project Work - Phase I

Aim

- To expose student to industry-standard project practices, through a real-life project work under time and deliverable constraints, applying the knowledge acquired through various courses.

Objectives

- To provide an opportunity to apply the knowledge gained through various courses in solving a real-life problem
- To provide an opportunity to practice different phases of software/system development life cycle
- To introduce the student to a professional environment and/or style typical of a global IT industry
- To provide an opportunity for structured team work and project management
- To provide an opportunity for effective, real-life, technical documentation
- To provide an opportunity to practice time, resource and person management.

Project Guidelines

- Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application-oriented concepts.

- The project work should be done only under the supervision of the Faculties.
- Project should have minimum 3 modules and maximum 5 modules
- Students should be complete the following steps in phase I

Synopsis

1. **Introduction**
 1.2 System Specification
 1.2.1 Hardware Configuration
 1.2.2 Software Specification
2. **System Study**
 2.1 Existing System
 2.1.1 Drawbacks
 2.2 Proposed System
 2.2.1 Features
3.Brief description of Modules

SEMESTER V

Semester V

Machine Learning Techniques

Course Outcomes:

- Understand the inference and learning algorithms for the hidden Markov model.
- Demonstrate Dimensionality reduction Techniques
- Explain the regression methods, classification methods, clustering methods

UNIT-I

Introduction to Machine Learning

Introduction- overview of machine learning- Different forms of learning- Generative 6 learning- Gaussian parameter estimation- maximum likelihood estimation- MAP estimation- Bayesian estimation- bias and variance of estimators- missing and noisy features- nonparametric density estimation- applications- software tools.

UNIT II

Classification Methods

Classification Methods-Nearest neighbor- Decision trees- Linear Discriminant Analysis - Logistic regression-Perceptron's- large margin classification- Kernel methods- Support Vector Machines. Classification and Regression Trees.

UNIT III

Graphical Models – Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution –Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields –Hidden Markov Models – Tracking Methods

UNIT IV

Clustering Methods -Clustering Methods-Partitioned based Clustering - K-means- K-medoids; Hierarchical

Clustering - Agglomerative- Divisive- Distance measures; Density based Clustering -DBScan; Spectral clustering.

Reference Books:

1. T. Hastie, R. Tibshirani and J. Friedman, ―Elements of Statistical Learning‖, Springer, 2009.
2. Ethem Alpaydin, ―Introduction to Machine Learning‖, Second Edition, MIT Press, 2010.
3. K. Murphy, ―Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012.
4. C. Bishop, ―Pattern Recognition and Machine Learning, Springer‖, 2006.
5. Shai Shalev-Shwartz, Shai Ben-David, ―Understanding Machine Learning: From Theory to Algorithms‖, Cambridge University Press, 2014.

Semester V

Artificial Intelligence and knowledge Representation

Course Outcomes:

- Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- Understanding about the basic concepts of Software agent's ad representation of Knowledge
- Demonstrate awareness and a fundamental understanding of various applications of AI

UNIT-I

Introduction: Artificial Intelligence- problems, scope and applications, Problem space and search- Production system- characteristics- the predicate calculus, Inference rules, Structures and strategies for state space search, strategies for space search, using state space to represent reasoning with the predicate calculus.

UNIT II

Game Playing - The Minimax search procedure, adding Alpha-beta cut-offs, Additional refinement, Iterative deepening, Planning system and its components, Understanding, Understanding as constrained satisfaction.

UNIT III

Knowledge representation issues, representation and mappings, representing simple facts in logic, Representing instances and ISA relationships, Computable functions and Predicates, Resolution, conversion to clausal form, Unification algorithm, Natural deduction. Knowledge representation using rules, logic programming, forward versus backward reasoning, Symbolic reasoning under uncertainty- Nonmonotonic reasoning, Slot and filler structures: Semantic nets, frames, conceptual dependency,
scripts.

Unit IV:

Machine Learning - rote learning, learning by taking advice, learning in problem solving, learning from examples, Explanation based learning, Analogy, formal learning theory, Connectionist models- Hopfield networks, learning in neural networks, back propagation, applications of neural networks, Genetic algorithm, classifier systems and genetic programming, artificial life and society-based learning.

Reference Books:

1. E. Rich, K. Knight and S.B.Nair, Artificial Intelligence, 3rd Edn.TMGH, New Delhi, 2009.
2. G.F. Luger and W.A Stubblefield, Artificial Intelligence - Structuresand Strategies for complex problem solving, Addison-Wesley-1998.
3. P.H Winston - Artificial Intelligence, Addison-Wesley-1992.
4. Nils J. Nilsson, Artificial Intelligence, A New Synthesis, Morgan Kauf 2000.
5. W.F. Clocksin and C.S. Mellish, Springer Verlag, Programming in Prolog 2003

Semester V

Principles of Deep Learning

Course Outcomes:

- Understand the basic concepts and techniques of Deep Learning.
- To understand and apply the Machine learning principles
- To study the deep learning architectures

UNIT I

Introduction to Learning -The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – SoftMax output layers

UNIT II

Deep Learning Models -Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs –Visualization

UNIT III

Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer –Applications

UNIT IV

Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM — Memory augmented Neural Networks – NTM—Application - Reinforcement Learning -MDP – Q Learning – Applications

Reference Book:

1.Nikhil Buduma, Nicholas Locascio, ―Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms‖, O'ReillyMedia, 2017.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ‖Deep Learning (Adaptive Computation and Machine Learning series‖, MIT Press, 2017.

Semester V
Mobile Application Development

Course Outcomes:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop design for mobile applications for specific requirements

UNIT I

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications -Requirements gathering and validation for mobile applications

UNIT II

Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications –user interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV

Technology 1- Android

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server-side applications – Using Google Maps, GPS and Wi-Fi – Integration with social media applications.

Reference Books:

1.Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012

3.James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012

4.David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS Development: Exploring the iOS SDK”, Apress, 2013.

Semester V
Elective II - Operating System

Course Outcomes

- Understand hardware and software design requirements in the system
- Explain the File Management
- Understand the internal processing of CPU

UNIT I

Introduction to operating system: Operating system as the main component of system software’s as a resource manager, Structure of OS- shell, utilities, resource management routines, kernel, evolution of OS, multiprogramming, time sharing, real-time systems, parallel systems, distributed systems, OS functions, Characteristics of modern OS; Process

Management: Process description and control: process control block, Process states: operations on processes; concurrent process; threads; processes and threads; symmetric multiprocessing; micro Kernels. CPU Scheduling: Schedulers, Scheduling methodology, CPU Scheduling algorithms, performance comparison.

UNIT II:

Process synchronization- independent and concurrent processes, critical section, mutual Exclusion, Petersons solution, semaphore, classical synchronization problem-bounded buffer and reader/writer problem. Concept of inter-process communication. Deadlock- deadlock and starvation, conditions for deadlock, resource allocation problem, methods for handling deadlock-deadlock prevention, deadlock avoidance- Banker's algorithm, deadlock detection, deadlock recovery.

UNIT III

Memory Management & Protection: Concept of memory, address binding, Logical address, physical address, swapping, contiguous allocation- fixed partition, variable partition, fragmentation. Non-contiguous allocation– paging, segmentation. Virtual memory- demand paging, page fault, replacement algorithms, thrashing. Protection and security – mechanisms and policies, threats, accidental data loss, protection mechanisms, user authentication, attacks from inside, virus, antivirus.

UNIT IV

I/O & File Management I/O management – I/O hardware, application I/O interface, kernel I/O subsystem. Disk I/O, disk scheduling, RAID, disk cache. File management- file concept, access methods, directory structure, file system structure & implementation, directory implementation, allocation methods, free space management.

Reference Books:

1.Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles
2.Achyut S Godbole, Operating systems, McGRawhill, Third Edition

Semester V
Lab VI -Machine Learning Lab – II

Course Outcomes:

- Understand the basic concepts and techniques of Machine Learning.
- Explain the regression methods, classification methods, clustering methods.
- Understand the inference and learning algorithms for the hidden Markov model.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

Program List:

1. Exercises to solve the real-world problems using the following machine learning methods:

- Linear Regression
- Logistic Regression
- Multi-Class Classification
- Neural Networks
- Support Vector Machines
- K-Means Clustering & PCA

2. Develop programs to implement Anomaly Detection & Recommendation Systems.

3. Implement GPU computing models to solving some of the problems mentioned in Proble

Semester V
Skill Enhancement Course -
Ethical Hacking

Course Outcomes:

- Understand the concepts of scanning and system hacking K2
- Explain about penetration testing and its methodology
- Identify the various programming languages used by security professional

UNIT I

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack –Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing –

Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information -Tools– Locating the Network Range – Meta Search Engines.

UNIT II

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

UNIT III

Cracking Passwords – Password Cracking Websites – Password Guessing –Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges –Executing Applications – Keyloggers and Spyware.

UNIT IV

Programming For Security Professionals -Penetration Testing – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing–Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools.

Reference Books

1 EC-Council, ―Ethical Hacking and Countermeasures: Attack Phases‖, Cengage Learning,2010.
2 Jon Erickson, ―Hacking, 2nd Edition: The Art of Exploitation‖, No Starch Press Inc., 2008.
3 Michael T. Simpson, Kent Backman, James E. Corley, ―Hands-On Ethical Hacking andNetwork Defense‖, Cengage Learning, 2013.
4. Patrick Engebretson, ―The Basics of Hacking and Penetration Testing – Ethical Hacking And
Penetration Testing Made Easy‖, Second Edition, Elsevier, 201.

SEMESTER VI

Semester VI
Pattern Recognition

Course Outcomes

- Summarize the various techniques involved in pattern recognition
- Categorize the various pattern recognition techniques into supervised and unsupervised.
- Illustrate the artificial neural network-based pattern recognition
- Discuss the applications of pattern recognition in various applications

UNIT I

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II

Clustering for unsupervised learning and classification–Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III

Structural Pattern Recognition-

Principle component analysis, independent component analysis, Linear discriminant analysis, Feature selection through functional approximation – Elements of formal grammars, Syntactic description – Stochastic grammars – Structural Representation.

UNIT IV

Artificial neural network model, Neural network-based pattern associators, Feed forward networks and training by back-propagation- ART networks. Plications of statistical and neural network – based pattern classifiers in speech recognition, image recognition and target.

Reference Books:

1. Andrew Webb, "Stastical Pattern Recognition", Arnold publishers, London,1999.
2. C.M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
3.M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011.
4.. Menahem Friedman, Abraham Kandel, "Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific publishing Co. Ltd, 2000.

Semester VI
Data Base Management System

Course Outcomes:

- Understand the fundamental concepts of Database Management Systems and Entity Relationship Model and develop ER Models.
- Understand the concepts of functional dependencies, normalization and apply such knowledge to the normalization of a database.
- Analyze the trends in data storage, query processing and concurrency control of modern database technologies

UNIT – I

Introduction -File System vs. DBMS – Views of data – Data Models – Database Languages – Database Management System Services – Overall System Architecture – Data Dictionary – Entity –Relationship (E-R) – Enhanced Entity – Relationship Model.

UNIT – II

Relational Model – Relational Data Structure – Relational Data Integrity – Domain Constraints – Entity Integrity – Referential Integrity – Operational Constraints – Keys –Relational Algebra – Fundamental operations – Additional Operations –Relational Calculus -Tuple Relational Calculus– Domain Relational Calculus - SQL – DDL-DML-Select– Set operations – Aggregate Functions – Null values – Nested Sub queries – Derived Relations –Views – Modification of the database – Joined Relations

UNIT – III

Database Design -Functional Dependencies – – Decomposition –Normalization using Functional Dependencies – Normalization using Multi-valued Dependencies – Normalization using Join Dependencies – Domain - Key Normal form.

UNIT - IV

Distributed Databases - Homogeneous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control in Distributed databases - Availability - Distributed Query Processing - Heterogeneous Distributed Databases- Cloud-Based Databases - Directory Systems.

Reference Books:

1.Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖,Sixth Edition, Tata McGraw Hill, 2011

2. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition, Pearson, 2011.

3. Raghu Ramakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.

4.C. J. Date, A.Kannan, Swaminathan, An Introduction to Database Systems, 8th Edition, Addison Wesley, 2012.

Semester VI
Capstone - Project Work- Phase II

Aim

- To expose the student to industry-standard project practices, through a real-life project work under time and deliverable constraints, applying the knowledge acquired

through various courses.

Objectives

- To provide an opportunity to apply the knowledge gained through various courses in solving a real-life problem
- To provide an opportunity to practice different phases of software/system development life cycle
- To introduce the student to a professional environment and/or style typical of a global IT industry
- To provide an opportunity for structured team work and project management
- To provide an opportunity for effective, real-life, technical documentation
- To provide an opportunity to practice time, resource and person management.

Project Guidelines

- Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application-oriented concepts.

- The project work should be done only under the supervision of the faculties.
- Project should have minimum 3 modules and maximum 5 modules
- Students should be complete the following steps in phase II

Format

Acknowledgement
Declaration
Certificate
Contents
Synopsis

1. **Introduction**

1.1 Organization Profile
1.2 System Specification
1.2.1 Hardware Configuration
1.2.2 Software Specification

2. **System Study**

2.1 Existing System
2.1.1 Drawbacks
2.2 Proposed System
2.2.1 Features

3. **System Design and Development**

3.1 File Design
3.2 Input Design
3.3 Output Design
3.4 Database Design
3.5 System Development
3.5.1 Description of Modules (Detailed explanation about the project work)

4. **Software Testing and Implementation**

Conclusion

Bibliography

Appendices

A. Data Flow Diagram

B. Table Structure

C. Sample Coding

D. Sample Input

E. Sample Output