Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed - to - be - University under section 3 of UGC Act 1956)
BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
No.173, Agharam Road, Selaiyur, Chennai, T.N - 600 073.

Requisition Letter

From
Dr. K.P Kaliyamurthie
Professor & Head,
Department of CSE,
Bharath Institute of Higher Education and Research,
Chennai

Date: 03.01.2019

To
The Dean Engineering,
Bharath Institute of Higher Education and Research,
Chennai

Respected sir,

Subject : Request of Permission to conduct a value added course on "**Reinforcement Learning**" -Reg

With reference to above subject, I would like to bring to your kind notice that, our department interested to organize value added course on "**Reinforcement Learning**" in our campus premises from 30.01.2019 for 38hours

Ourinternal Professorswould deliver lecture for the above mentioned course. About 50 students would be participating in this course. We request you kindly to give permission to organize this.

Venue: **CSEClass room**

Timing : 1:30 PM to 4:30 PM Friday (AN) and

9.00 PM to 4.00 PM Saturday (FN&AN).

Submitted to Principal for approval to organize this value added course.

HOD/CSE

DEAN ENGINEERING

HEAD OF DEPARTMENT
Department of Computer Science & Engg.,
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Chennai-600 073. INDIA

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CIRCULAR

25.01.2019

The School of computing, Bharath Institute of Higher Education and Research is planned to conduct a certification value added course on **Reinforcement Learning**for the benefit of II, III and IV year students. This course is scheduled from30.01.2019 for 38hours which includes theory and practical. The timings are 1:30 PM to 4:30 PM from Friday (AN) and Saturday (FN&AN).

All Registered Students must attend all the classes without fail. The following faculty members are assigned to handle the course. S.NO	**Name of the Faculty**	**Designation**
1	Dr.K.P.Kaliyamurthie	Professor
2	Dr.C.Rajabhushanam	Professor

Head of Department

HEAD OF DEPARTMENT
Department of Computer Science & Engg.,
Bharath Institute of Higher Education & Research
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Chennai-600 073, INDIA

To

Copy to CSE

Copy to IT

CERTIFICATE COURSE ON REINFORCEMENT LEARNING

Date of Introduction of the Course:30.01.2019

COURSE OBJECTIVE

Reinforcement Learning is a subfield of Machine Learning, but is also a general purpose formalism for automated decision-making and AI. This course introduces you to statistical learning techniques where an agent explicitly takes actions and interacts with the world. Understanding the importance and challenges of learning agents that make decisions is of vital importance today, with more and more companies interested in interactive agents and intelligent decision-making. This course introduces you to the fundamentals of Reinforcement Learning.

WHAT TO EXPECT

- ✓ Formalize problems as Markov Decision Processes
- ✓ Understand basic exploration methods and the exploration/exploitation tradeoff
- ✓ Understand value functions, as a general-purpose tool for optimal decision-making
- ✓ Know how to implement dynamic programming as an efficient solution approach to an industrial control problem

COURSE SYLLABUS

1. **Introduction to RL and immediate RL**
   - Introduction to RL
   - RL Framework and applications
   - Introduction to immediate RL
   - Bandit optimalities
   - Value function based methods

2. **Bandit algorithm**
   - UCB 1
   - Concentration bounds
   - UCB 1 theorem
   - PAC bounds
   - median elimination
   - Thompson sampling

3. **Policy gradient methods and introduction to full reinforcement learning**
   - Policy search
   - Reinforce
   - Contextual bandits
   - Full reinforcement learning introduction
   - Returns , value functions and MDP

4. **MDP formulation, bellman equations and optimality proof**
   - MDP modelling
   - Bellman equations
   - Bellman optimality equation
   - Cauchy sequence and green's equation
   - Banach fixed point theorem
   - Convergence proof

5. Dynamic programming and Monte Carlo methods

- Lpi convergence
- Value iteration
- Policy iteration
- Dynamic programming
- Montu kar lo
- Control in Monte Carlo

6. Monte Carlo and temporal difference methods .

- Off policy MC
- UCT
- TD(0)
- TD(0) control
- Q learning
- After state

7. Eligibility traces

- eligibility traces
- Backward view of eligibility traces
- Eligibility trace control
- Thompson sampling recap

8. Function approximation

- Function approximation
- Linear parametrization
- State aggregation methods
- Function of approximation and eligibility traces
- LSTD & LSTDQ
- LSPI & fitted Q

9. **DQN , Fitted Q & policy gradient approaches**
   - DQN and fitted Q Iteration
   - Policy gradient approach
   - Actor critic and reinforce
   - Policy Gradient with function approximation

10. **Hierarchical reinforcement learning**
    - Hierarchical Enforcement learning
    - Types of optimality
    - Semi Markov decision processes
    - Options
    - Learning with options
    - Hierarchical abstract machines.

11. **Hierarchical reinforcement learning - MAXQ**
    - MAXQ
    - MAXQ value function decomposition
    - Option Discovery

12. **POMDP**
    - POMDP introduction
    - Solving POMDP

COURSE COORDINATOR **HEAD OF THE DEPARTMENT**

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CERTIFICATE COURSE ON REINFORCEMENT LEARNING

Date of Course Introduction 30/01/2019

School Of Computing

Registered Students List

S.NO	REG.NO	NAME OF THE STUDENT
1	U15CS001	ABHIJEET KUMAR
2	U15CS002	ABHIJIT KUMAR GUPTA
3	U15CS003	ABHISHEK KUMAR SINGH
4	U15CS004	ALLU SAI SIVA PRIYANKA NAIDU
5	U15CS005	AMBIKE KUMAR SINGH
6	U15CS006	ANBUMANI S
7	U15CS007	ANJAR ALI
8	U15CS008	ANKAM MANJUNATH
9	U15CS009	ANNADI DHANUSH
10	U15CS011	ANUMOLU YESWANTH
11	U15CS012	ARAVAPALLI SIVA VINAYA
12	U15CS013	ARAVINDHAN K R
13	U15CS014	ARVIND KUMR YADAV
14	U15CS015	ARYAN SAHU
15	U15CS016	ASHISH AGARWAL
16	U15CS064	INJE RAVI TEJA
17	U15CS065	INNURU SWATHI
18	U15CS066	JAGADEESH K
19	U15CS067	JAGADEESWARA RAO JADDU
20	U15CS068	JAICHAND KUMAR
21	U15CS069	JANAKI RAMAN V
22	U15CS071	JOHN PARAM JYOTHI JYOTHULA
23	U15CS073	K THULASIRAM
24	U15CS074	KADALI VINAYNARASIMHA
25	U15CS075	KADUMU MOUNIKA
26	U15CS076	KAIPU PRANAY REDDY
27	U15CS077	KALYANAM JASWANTH NAIDU
28	U15CS078	KAMBLE NIKHIL KUMAR
29	U15CS079	KANCHARLAPALLI LOKESHWAR RAO
30	U15CS080	KANCHUMARTHI BHUVANESWAR VINAY
31	U15CS127	MUPPALLA SURENDRA
32	U15CS128	MURARI KUMAR CHAUDHARY
33	U15CS129	N SWAPNA RAAGA
34	U15CS130	NAGANNAGARI JAGADISH
35	U15CS133	NALLURI AKHIL BABU
36	U15CS134	NAMBURI VIJAY KUMAR

37	U15CS135	NARENDULA NIREESHA
38	U15CS136	NARESH K
39	U15CS138	NEELA SAI KUMAR
40	U15CS139	NIKHIL KUMAR
41	U15CS140	NIRANJAN S
42	U15CS141	NITIN SINGH
43	U15CS142	NUKALA BHODANANDA CHARAN
44	U15CS143	OLIVER S
45	U15CS144	OMPRAKASH YADAV
46	U15CS191	SEETAPTI HEMA SEKHAR
47	U15CS192	SESHA SRUJAN.B
48	U15CS193	SHAIK AFRIDI
49	U15CS194	SHAIK SABIR
50	U15CS195	SHAIK YASMEEN

Course Coordinator **HOD**

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CERTIFICATE COURSE ON REINFORCEMENT LEARNING

Date of Introduction of the Course:31.01.2019

The timings are 1:30 PM to 4:30 PM from Friday (AN) and Saturday (FN&AN)

Time Table& Lesson plan

CLASS	DATE	TOPIC
1,2	30-01-2019	• Introduction to RL • RL Framework and applications
3,4, 5,6	02-02-2019	• Introduction to immediate RL • Bandit optimalities • Value function based methods • UCB 1 • Concentration bounds • UCB 1 theorem
7,8	08-02-2019	• PAC bounds • median elimination • Thompson sampling
9,10, 11,12	09-02-2019	• Policy search • Reinforce • Contextual bandits • Full reinforcement learning introduction • Returns , value functions and MDP
13,14	15-02-2019	• MDP modelling • Bellman equations • Bellman optimality equation • Cauchy sequence and green's equation

15,16, 17,18	**16-02-2019**	• Banach fixed point theorem • Convergence proof • Lpi convergence • Value iteration • Policy iteration
19,20	**22-02-2019**	• Dynamic programming • Montu kar lo • Control in Monte Carlo • Off policy MC
21,22, 23,24	**23-02-2019**	• UCT • TD(0) • TD(0) control • Q learning • After state
25,26	**01-03-2019**	• eligibility traces • Backward view of eligibility traces • Eligibility trace control • Thompson sampling recap
27,28, 29,30	**02-03-2019**	• Function approximation • Linear parametrization • State aggregation methods • Function of approximation and eligibility traces • LSTD & LSTDQ • LSPI & fitted Q
31,32	**08-03-2019**	• DQN and fitted Q Iteration • Policy gradient approach • Actor critic and reinforce • Policy Gradient with function approximation
33,34,35,36	**09-03-2019**	• Hierarchical Enforcement learning • Types of optimality • Semi Markov decision processes • Options • Learning with options • Hierarchical abstract machines.

37,38	**15-03-2019**	• MAXQ • MAXQ value function decomposition • Option Discovery • POMDP introduction • Solving POMDP

COURSE COORDINATOR

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TO THE STARS BY HARD WORK

BIHER UNIVERSITY

INDIA

CERTIFICATE OF PARTICIPATION

This is Presented to

Mr. ABHIJEET KUMAR

For actively participating in value added course on "***Reinforcement Learning***" conducted by School Computing , BIHER from 30-01-2019 to 15-03-2019 .

Coordinator HOD DIRECTOR

COURSE FEEDBACK FORM

Academic Year	2019-20				
Term					
Course Number	–				
Course Title	Reinforcemant Learning				
Number of Credits	–				
Type of Course	Regular		Elective		Add-on ✓

I.	**Information on the Respondent: (Tick (√) Appropriately)**									
1.	**Percentage of classes attended**									
	0-20		20-40		40-60		60-80	✓	80-100	
2.	**Number of hours per week spent on the course (Other than lecture hours)**									
	0-2		2-4		4-6		6-8		8-10	✓

3.	**Preparation for the course by the student:**		
	(i)	Have done part of this course earlier	No
	(ii)	Has adequate prior exposure to the prerequisites	No
	(iii)	Had to pickup relevant additional topics through concurrent study	Yes
	(iv)	Have no exposure to the background material	No
4.	**The expectations for taking the course by the student are:**		
	(a)	Enhance by skill base in the area of specializations	Yes
	(b)	Get exposed to a relevant subject	Yes
	(c)	Curiosity	Yes
	(d)	Better Employment Opportunity	Yes
	(e)	Complete Course requirements	Yes
	(f)	To Improve CGPA	Yes

About the Instructor: Information on the Respondent: (Tick (√) Appropriately)

		A	B	C	D	E
1.	Pace of the Teaching/lecture	✓				
2.	Comment of the Subject	✓				
3.	Clarity of expression	✓				
4.	Level of preparation		✓			
5.	Level of interaction	✓				
6.	Accessibility outside the class	✓				
7.	Others (please specify					

A: Excellent		**B: Very Good**	✓	**C: Good**		**D: Satisfactory**		**E: Poor**	

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CERTIFICATE COURSE ON REINFORCEMENT LEARNING

Date of Course Introduction 30/01/2019
School of Computing

COURSE COORDINATOR **HEAD OF THE DEPARTMENT**

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COURSE FEEDBACK FORM

Academic Year	2018 - 2019					
Term						
Course Number						
Course Title	Reinforcement Learning					
Number of Credits						
Type of Course	Regular		Elective		Add-on	✓

I.	**Information on the Respondent: (Tick (√) Appropriately)**									
1.	**Percentage of classes attended**									
	0-20		20-40		40-60		60-80	✓	80-100	
2.	**Number of hours per week spent on the course (Other than lecture hours)**									
	0-2		2-4		4-6	✓	6-8		8-10	

3.	**Preparation for the course by the student:**		
	(i)	Have done part of this course earlier	NO
	(ii)	Has adequate prior exposure to the prerequisites	yes
	(iii)	Had to pickup relevant additional topics through concurrent study	yes
	(iv)	Have no exposure to the background material	yes
4.	**The expectations for taking the course by the student are:**		
	(a)	Enhance by skill base in the area of specializations	yes
	(b)	Get exposed to a relevant subject	yes
	(c)	Curiosity	yes
	(d)	Better Employment Opportunity	yes
	(e)	Complete Course requirements	yes
	(f)	To Improve CGPA	yes

About the Instructor: Information on the Respondent: (Tick (√) Appropriately)

		A	B	C	D	E
1.	Pace of the Teaching/lecture		✓			
2.	Comment of the Subject		✓			
3.	Clarity of expression		✓			
4.	Level of preparation		✓			
5.	Level of interaction	✓				
6.	Accessibility outside the class	✓				
7.	Others (please specify					

A: Excellent		**B: Very Good**	✓	**C: Good**		**D: Satisfactory**		**E: Poor**	

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