Total No. of Questions – [06] Total No. of Printed Pages: 2

G.R. No.	

DECEMBER 2021- END-SEM

B. TECH. (Electronics and Telecommunications)

(SEMESTER - I)

Deep Learning (ETUA40182A) Elective V

(PATTERN 2018)

Time: [1 Hour] [Max. Marks: 30]

(*) Instructions to candidates:

1) **Answer Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6.**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) **a)** In variational autoencoder, if ∅ and θ are the parameters of the discriminator (encoder) and generator (decoder) respectively. Calculate the optimized Evidence Lower Bound(ELBO) if Probability $P_\theta(x)=0.5$ **[4]**

b) In multivariate system, the normalized distributions P(x) and Q(x) are defined as P(x)= N $(x;\mu_1,\Sigma_1)$ and Q(x)= N $(x;\mu_2,\Sigma_2)$ prove that KL Divergence $D_{KL}(P(x)||Q(x))$ is given by $\frac{1}{2}[\ log\frac{|\Sigma_2|}{|\Sigma_1|}$ - k +tr$(\Sigma_2^{-1}\Sigma_1) + (\mu_1-\mu_2)^T\Sigma_2^{-1}\ (\mu_1-\mu_2)]$ **[6]**

OR

Q.2) **a)** Covid test of 137 samples in a society located in suburban of Pune city is as shown in the Table. Calculate the probability of tested positive P(T+) . **[4]**

Truth	Positive	Negative	Total
Symptoms	44	23	67
Healthy	10	60	70
Total	54	83	137

b) Discriminate in details autoenocder and variational Autoencoder along with one applications each. **[6]**

Q.3) **a)** In GAN ,If the distribution of the image data $p_{data}(x)=1$ and distribution of the generator $p_g(x) = 0.6$,Calculate the value of $D^*_G(x)$. **[4]**

b) An Engineer who also likes an art want to convert natural scene images into paintings. Suggest him a suitable deep learning architecture, draw and present its workflow. **[6]**

OR

Q.4) **a)** Mode collapse and counting are the serious drawbacks of Generative Adversarial Networks (GAN). Justify. **[4]**

b) In Generative Adversarial Network (GAN), if $p_{data}(X = x)$ distribution over entire dataset, $p_z(Z)$ is distribution of the noise input. The discriminator will be $D(x; \theta_d)$ and generator will be $G(z; \theta_g)$, the distribution of the generator output will be $p_g(x)$ and $D(X)$ the probability of the discriminator. Prove that the loss function will be given $\min_G \max_D V(D,G) = \{\mathbb{E}_{x\sim p_{data}(x)}[\log(D(x))] + \mathbb{E}_{z\sim p_z(Z)}\log[\,1-(D(G(z))]\}$ **[6]**

Q.5) **a)** In a reinforcement based three step game reward at step 0(initially) is 10, step 1 is -5 and step 2 is 20. Taking discount factor equal to 0.7, Calculate the total reward.
Total reward equation $R_t = \gamma^0 r_t + \gamma^1 r_{t+1} + \gamma^2 r_{t+2} + \cdots + \gamma^{t+n} r_{t+n})$ **[4]**

b) Illustrate the entire reinforcement learning process using block diagram indicating all the components. **[6]**

OR

Q.6) **a)** In a deterministic environment shown below, agent can move left, right, up and down. When agent moves into position (0, 2) he wins and gets 10 points and if moves into (1, 2) position he losses and gets a penalty of 10 points. In an episode agent moves from start (0, 0) goes right to (0,1) then turns down to (1,1) and moves right. What will be the reward if discount factor of 0.9 is considered? The arrows indicate the direction of the movement of the agent ($\uparrow up, \downarrow down, \rightarrow right, \leftarrow left$) **[4]**

START (0,0)	(0,1)	(0,2) WIN
(0,1)	(1,1)	(1,2) Loose

b) In context with reinforcement learning, justify the use of Q function in the Bellman's equation used in Q learning. **[6]**