NATIONAL INSTITUTE OF TECHNOLGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
End Semester Examination Dec-2022

B. Tech: CSE -VIIth semester — Course Name: Recommendation Systems
Course Code: **CS7452** — Max. Marks : 60
Maximum Time: 3 Hours

Instructions:

1. *Attempt all questions.*
2. *Assume any suitable data, if necessary.*
3. *Answer all parts of question at the same place.*

Q1. Given below a user-item rating matrix (R), where rows represent users and columns represent items.

Users ↓	Items →			
	I_1	I_2	I_3	I_4
U_1	3		2	1
U_2	3	1	2	4
U_3	1	3		
U_4	2	5	3	1
U_5	5	4	5	

Entries inside the user-item rating matrix represent ratings of different users. U is the number of users and I is the number of items. When applied SVD to the matrix R then U and V^T matrix are as follows:

$$U = \begin{bmatrix} -0.29 & 0.335 & -0.42 & 0.26 & -0.74 \\ -0.00 & -0.53 & -0.69 & 0.37 & 0.29 \\ -0.83 & -0.34 & 0.38 & 0.19 & 0.02 \\ 0.47 & -0.41 & 0.41 & 0.51 & -0.42 \\ 0.00 & 0.55 & 0.12 & 0.69 & 0.43 \end{bmatrix} \quad V^T = \begin{bmatrix} -0.65 & -0.10 & 0.73 & 0.14 \\ 0.33 & -0.46 & 0.37 & -0.72 \\ -0.34 & 0.68 & -0.08 & -0.63 \\ 0.58 & 0.55 & 0.55 & 0.19 \end{bmatrix}$$

Consider only K=3 latent features and apply matrix factorization techniques to generate P (i.e.UxK) and Q^T (i.e. KxI) matrix. Generate the predicted rating of *User 3* (U_3) for *Item 3* (I_3). *Consider the biases of users and items while generating the predicted rating.* [CO1, CO3] [L2, L3] **15 marks**

Q2. a. According to *Burke,* what are the main categories of hybrid recommender system? Explain each in short. [CO1, CO3] [L1] **10 marks**

b. What are the general goals of evaluation design? Explain each in short. [CO3] [L1] **5 marks**

Q3. a. Consider user profiles are represented by vector of five terms, in the user-term (C) matrix, It is shown below.

Users ↓	Items →				
	T_1	T_2	T_3	T_4	T_5
U_1	3	0	2	1	2
U_2	3	1	2	4	1
U_3	1	3	0	0	1
U_4	2	5	3	1	2
U_5	5	4	5	0	1

Use normalized term frequencies (TF) to generate user vectors, and then find the most similar user to the target user U_1 based on the cosine similarity. [CO1, CO3] [L2, L3] **10 marks**

b. How rule based classifiers are used to generate the recommendations for the users. [CO1, CO3] [L1] **5 marks**

Q4. a. What is item based collaborative filtering? How significance weighing is used to de-emphasize the importance of the pair of users that have very small number of ratings in common? [CO1, CO3] [L1] **5 marks**

b. Given below a user-item rating matrix (R), where rows represent users and columns represent items.

Users ↓	Items →		
	I_1	I_2	I_3
U_1	2		3
U_2	5	2	
U_3	3	3	1
U_4		2	2

Use item based collaborative filtering and adjusted cosine similarity, to find the predicted rating of an item I_2 for the target user U_1. [CO1, CO3] [L2, L3] **10 marks**

**********ALL THE BEST**********