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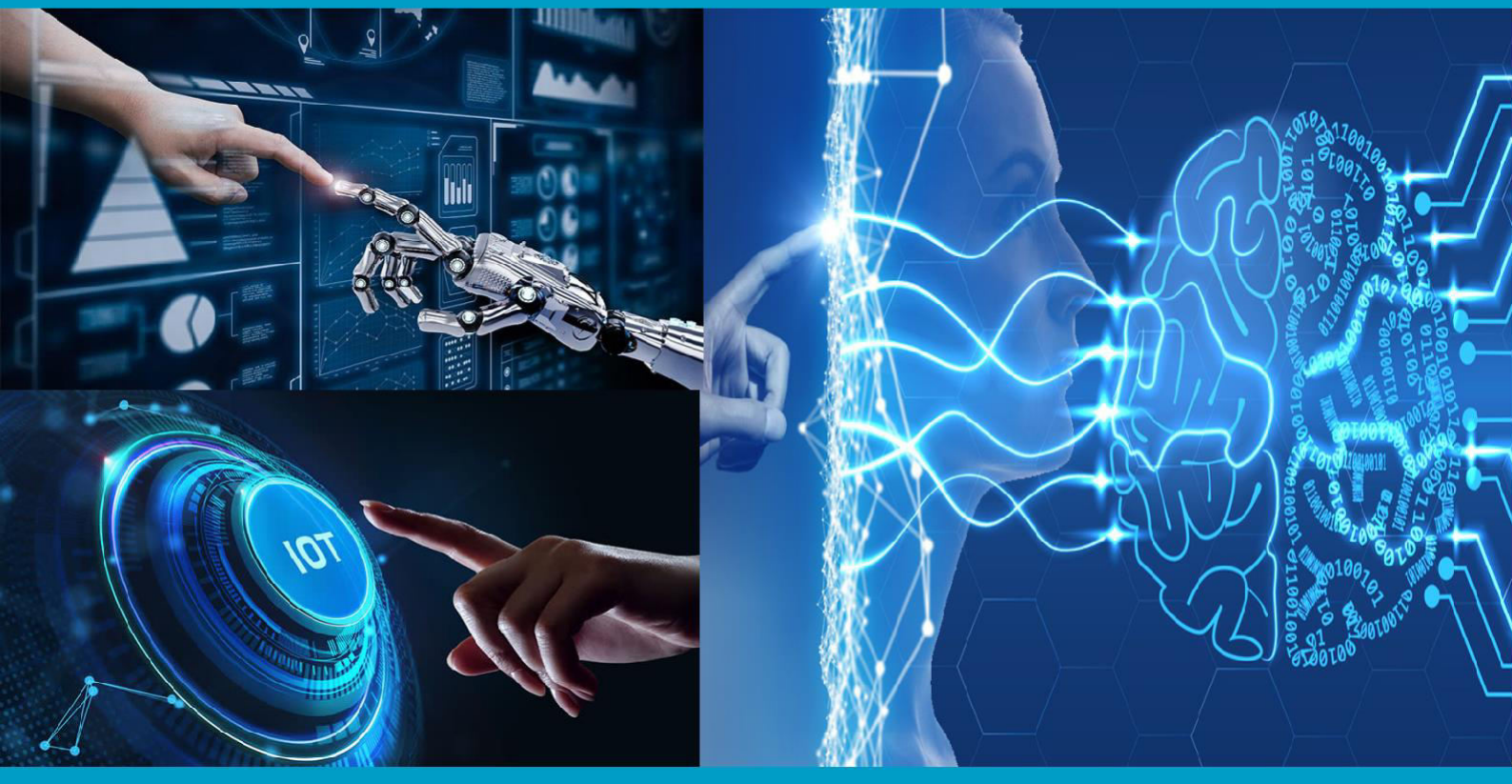

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Automatic Question Paper Generation Using Bloom's Technology

Mr. H.M. Gaikwad[1], Mrs. D.S. Chopada[2], Yash Darji[3], Ranveer Deshmukh[4], Atharva Kapadne[5], Yash Kothule[6]

Head, Dept. of AIML, K.K. Wagh Polytechnic, Nashik, India[1]

Dept. of AIML, K.K. Wagh Polytechnic, Nashik, India[2]

Third Year Students, Dept. of Artificial Intelligence and Machine Learning, K.K. Wagh Polytechnic, Nashik, India[3,4,5,6]

ABSTRACT: In any educational course curriculum, the courses are defined with learning objectives. Teachers conduct assessments to know if students have achieved certain learning objectives or not. Teachers generate variety of question papers as per the universities' assessment requirements. It is very challenging for the teachers to make question papers with varied questions and which meet learning objectives of the course. There are no standardized methods to ensure quality of question paper. Hence there arises a need to have a system which will automatically generate the question paper from teacher entered specification within few seconds. Researchers recommend different sets of tags such as cognitive level, difficulty level, type of question, content /topic for defining a question etc. In this system, we proposed an autonomous question paper-generation system. In our system we allow users to input a set of questions. We also allow the user to provide complexity for each of these questions. After this, the system will assign marks to each question based on Bloom's taxonomy using machine learning and then the questions are stored in the database along with their marks. The system enables teachers to input a set of questions, defines complexity levels, and assigns marks based on Bloom's Taxonomy. Machine learning algorithms, such as Naïve Bayes, are utilized for categorizing questions and assessing subjective answers through keyword matching. By streamlining question generation and subjective answer evaluation, this system reduces the time and effort required while maintaining quality and security in the assessment process..

KEYWORDS : Question paper generation, Machine learning, Text mining, Bloom's taxonomy.

I. INTRODUCTION

In the field of education, the process of generating question papers plays a crucial role in assessing students' understanding and knowledge acquisition. However, the manual creation of question papers can be time-consuming and prone to human errors. To address this challenge, an innovative solution has been developed: an Automatic Question Paper Generation system with marks allocation using Bloom's Taxonomy. This system leverages the power of technology, specifically linear regression and the Random Forest algorithm, to automate the question paper generation process. By analyzing a set of questions provided by the examiner, the system intelligently generates a well-structured and balanced question paper that aligns with the learning objectives and Bloom's Taxonomy. The primary objective of this system is to streamline the process of question paper generation while ensuring fairness and reliability in marks allocation. By automating the allocation of marks, the system reduces the subjectivity and bias that may arise from manual evaluation. Additionally, it incorporates Bloom's Taxonomy, a widely recognized framework for categorizing educational objectives, to ensure that the question paper covers a range of cognitive levels and promotes higher-order thinking skills.

The technologies employed in this system include linear regression and the Random Forest algorithm. Linear regression is used to analyze the relationship between various factors such as difficulty level, question type, and marks allocation. This analysis helps in determining the appropriate weight-age for each question and ensures an equi table distribution of marks across the question paper. On the other hand, the Random Forest algorithm utilizes a decision tree-based ensemble learning approach to predict the difficulty level and Bloom's Taxonomy level for each question. Overall, the Automatic Question Paper Generation system with marks allocation using Bloom's Taxonomy represents a significant advancement in the field of educational assessment. By leveraging advanced algorithms and incorporating Bloom's Taxonomy, this system offers an efficient, objective, and fair approach to generate question papers that effectively evaluate students' knowledge and cognitive abilities.

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II. LITERATURE REVIEW

Nowadays, question papers are created manually by educators, which is time-consuming and prone to human bias. Teachers have to ensure that questions cover the entire syllabus while maintaining appropriate difficulty levels. This method often suffers from repetition of questions and lacks proper alignment with course objectives.

However, this method is prone to human bias**.** Educators might unknowingly favor certain topics or types of questions they are more comfortable with, or they might unintentionally repeat questions used in previous years. Additionally, ensuring that questions are appropriately difficult for the student level (i.e., balancing easy, moderate, and challenging questions) can be difficult, leading to inconsistencies in the paper's overall difficulty.

[1]"Automatic Generation of Question Paper from User Entered Specifications Using a Semantically Tagged Question Repository," (G. Nalawade and R. Ramesh)
2016 IEEE Eighth International Conference on Technology for Education (T4E), 2016, pp.148-151, There are no standardized methods to ensure quality of question paper. Hence there arises a need to have a system which will automatically generate the question paper from teacher entered specification within few seconds. Researchers recommend different sets of tags such as cognitive level, difficulty level, type of question, content /topic for defining a question etc .The existing tools are rigid and support very basic or limited tags. The proposed system will automatically generate a question paper from semantically tagged question repository.

[2]"An algorithm for question paper template generation in question paper generation system,"(V. M. Kale and A. W. Kiwelekar) 2013 The International Conference on Technological Advances in Electrical, Electronics and Computer Engineering (TAEECE), 2013, pp. 256-261 - In this paper, we present the design of an algorithm to generate question paper template which satisfies the above mentioned constraints. The algorithm is illustrated in the paper by using four constraints namely question paper format, coverage of syllabus, coverage of difficulty levels and coverage of cognitive levels according to Bloom's taxonomy.

[3]"Secure Automatic Question Paper Generation with the Subjective Answer Evaluation System,"(R. Ragasudha and M. Saravanan)2022 International Conference on Smart Technologies and Systems for Next Generation Computing (ICSTSN), 2022, pp. 1-5, - This paper describes secure automatic question paper generation and also evaluates the answer which is computerizing in subjective format. For the automatic question paper generation, the admin has to create a database which is the form of question with bloom's taxonomy.

[4] "Neural Question Generation Using Question Type Guidance," (R. Sun, X. Zhou and F. Fang)2021 17th International Conference on Computational Intelligence and Security (CIS), 2021, pp. 328-332, - In this paper, author focus on how to exploit question type to guide the question generation task. The question type prediction task is introduced into our multi-task framework to discover the underlying relationship between the context-answer pair and the question. In additional, author also apply metric learning mechanism to improve the semantic relevance between the generated question and the context.

[5] Q. F. Cheng, H. T. Liu and X. M. Yang, "Design of Test Paper Strategy Based on Randomized Algorithm", Science Mosaic, vol. 34, no. 11, pp. 107-110, 2011- This paper proposes a randomized algorithm for designing test papers. The algorithm aims to create diverse and fair test papers by randomly selecting questions from a pool based on specified criteria.

[6] Z. C. Wang and X. Y. Ouyan, "Design of Intelligent Test Paper Generation System Based on Improved Genetic Algorithms", Computer Knowledge and Technology, vol. 16, no. 2, pp. 65-67, 2020- This paper presents an intelligent test paper generation system that uses improved genetic algorithms. The system generates test papers by optimizing a set of parameters to achieve desired characteristics such as difficulty level and question distribution.

[7] B. Zhao, H. Ning and R. B. Zhang, "Research and implementation of automatic test paper generation system based on genetic algorithm", Applied Science and Technology, vol. 48, no. 2, pp. 50-5, 2021- This paper explores the research and implementation of an automatic test paper generation system based on genetic algorithms. The system aims to generate high-quality test papers by optimizing the selection and arrangement of questions.

[8] J. Zhang, "Online Examination System of Automatic Paper Composition Based on Hybrid Algorithm", China Computer Communication, vol. 33, no. 7, pp. 97-99, 2021- This paper describes an online examination system that uses a hybrid algorithm for automatic paper composition. The system combines different algorithms to generate diverse and challenging test papers.

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III. SYSTEM ARCHITECTURE

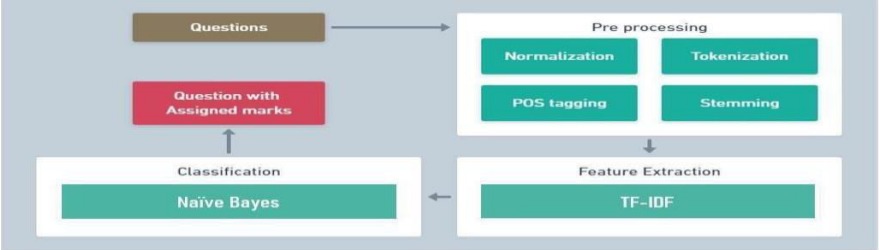

Fig.1 system architecture

1. **Data Pre-processing :-** Data preprocessing is a data mining technique which is used to transform the raw data in a useful and efficient format.
2. There are four tools and methods are going to be used in our system:

a) **Tokenization:** Tokenization is the process of dividing text into a set of meaningful pieces. These pieces are called tokens.

b) **Normalization:** Normalization means transforming the data, namely converting the source data in to another format that allows processing data effectively

c) **Stemming:** Stemming is a process where words are reduced to a root by removing inflection through dropping unnecessary characters, usually a suffix.

3. **Feature extraction** :- Feature extraction refers to the process of transforming raw data into numerical features that can be processed while preserving the information in the original data set.

a) **TF/IDF**:- TF-IDF stands for "Term Frequency — Inverse Document Frequency"This is a technique to quantify words in a set of documents. It can be defined as the calculation of how relevant a word in a series or corpus is to a text.

4. **Naïve Bayes:** A probabilistic classifier that assumes independence between features. It's used to categorize questions based on Bloom's taxonomy levels.

IV. METHODOLOGY

1. **Identify Learning Objectives:** Align objectives with Bloom's Taxonomy levels: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation.
2. **Develop a Comprehensive Question Bank:** Create diverse questions tagged with Bloom's Taxonomy levels.
3. **Use NLP Techniques for Question Analysis:** Analyze questions to identify keywords and verbs indicating cognitive levels.
4. **Develop an Algorithm for Question Selection:** Automatically select balanced questions covering all cognitive levels.
5. **Implement a Randomization Algorithm:** Randomize question selection to ensure diversity and fairness.
6. **Assign Weightage to Questions:** Allocate weightage based on cognitive levels and importance.
7. **Provide Feedback to Students:** Offer performance-based feedback to identify strengths and weaknesses.
8. **Continuously Evaluate and Improve:** Regularly assess and refine the system based on feedback from educators and students.

V. RESULT AND OUTPUT

Fig 2. Home Page

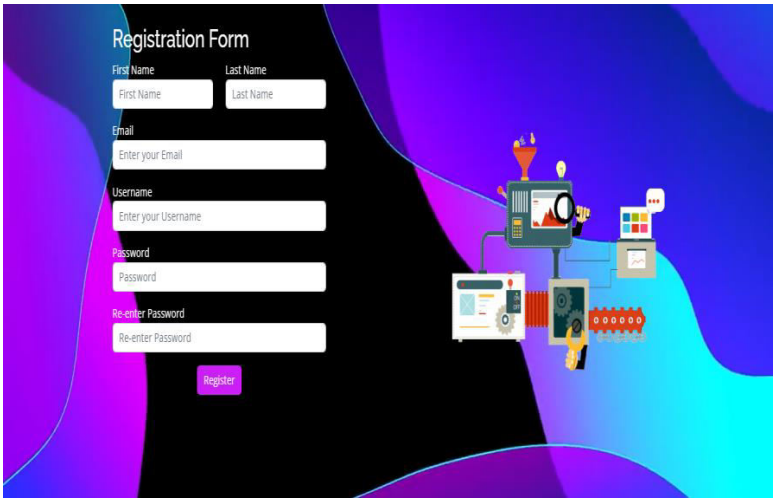

Fig 3. Registration Page

Fig 4. Login Page

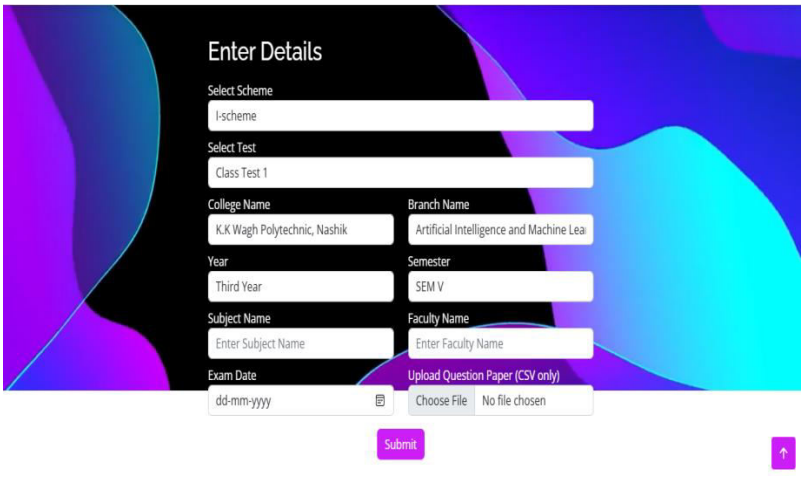

Fig 5. User Input Dashboard

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K.K Wagh Polytechnic, Nashik

Artificial Intelligence and Machine Learning [2024-25]

Class Test 1

Subject: ABC **Faculty: XYZ** **Duration:** 90 Minutes

Year: ThirdYear - SEM V **Marks:** 30 **Scheme: K-scheme** **Date: March 30, 2025**

1. Attempt all the questions compulsorily.
2. Draw Neat diagrams wherever necessary.
3. Use of scientific calculator is allowed.
4. Assume suitable data wherever necessary.
5. Figures to the right indicate full marks.

Sr.No.	All questions are compulsory	Blooms Level	Marks
Q1.	**Attempt the following questions (Any 5)**		**10 M**
a.	Explain components of the Android directory structure.	remember	2
b.	Write a program to demonstrate declaring and using permissions with any relevant example.	understand	2
c.	List different types of sensors used in Android.	understand	2
d.	State and elaborate the syntax of required classes and methods for Geocoding.	apply	2
e.	Explain the need for the Android Operating System and describe any four features of Android.	apply	2
f.	Write a program to demonstrate Date and Time picker.	understand	2
g.	Discuss the developer console with at least four features.	remember	2
Q2.	**Attempt the following questions (Any 5)**		**20 M**
a.	Differentiate between JVM and DVM.	apply	4
b.	Describe Android and the importance of OHA (Open Handset Alliance).	apply	4
c.	Develop an application to display a Google Map.	apply	4
d.	Define Fragment and Broadcast receiver.	apply	4
e.	Explain Dalvik Virtual Machine and state its importance.	apply	4
f.	Define Fragment and Broadcast receiver.	apply	4
g.	Write a program to demonstrate declaring and using permissions with any relevant example.	understand	4

Fig 6. Question Paper (K Scheme)

K.K Wagh Polytechnic, Nashik

Artificial Intelligence and Machine Learning [2024-25]

Class Test 1

Subject: ABC **Faculty: XYZ** **Duration:** 60 Minutes

Year: ThirdYear - SEM V **Marks:** 20 **Scheme: I-scheme** **Date: March 30, 2025**

1. Attempt all the questions compulsorily.
2. Draw Neat diagrams wherever necessary.
3. Use of scientific calculator is allowed.
4. Assume suitable data wherever necessary.
5. Figures to the right indicate full marks.

Sr.No.	All questions are compulsory	Blooms Level	Marks
Q1.	**Attempt the following questions(Any 4)**		**8 M**
a.	Discuss the developer console with at least four features.	remember	2
b.	List different types of sensors used in Android.	understand	2
c.	Explain components of the Android directory structure.	remember	2
d.	Write a program to demonstrate declaring and using permissions with any relevant example.	understand	2
e.	Write a program to demonstrate Date and Time picker.	understand	2
f.	State and elaborate the syntax of required classes and methods for Geocoding.	apply	2
Q2.	**Attempt the following questions(Any 3)**		**12 M**
a.	Differentiate between JVM and DVM.	apply	4
b.	Describe Android and the importance of OHA (Open Handset Alliance).	apply	4
c.	Develop an application to display a Google Map.	apply	4
d.	Define Fragment and Broadcast receiver.	apply	4

Fig.7 Question Paper (I Scheme)

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VI. CONCLUSION

This project introduces an innovative system for generating assessment question papers based on Bloom's Taxonomy. By utilizing the hierarchical structure of Bloom's Taxonomy, the system categorizes questions into distinct cognitive levels, from basic knowledge to advanced evaluation skills. This structured methodology enhances assessment quality and aligns with modern educational standards focusing on critical thinking and reducing the time educators spend on question paper creation. The capability to generate multiple question papers from a single question pool offers flexibility, allowing educators to tailor assessments to various student needs without compromising question quality. This system provides adaptability particularly valuable in standardized testing environments, reducing question predictability and enhancing assessment integrity. Overall, this project marks a significant advancement in assessment practices, empowering educators and enriching the student learning experience.

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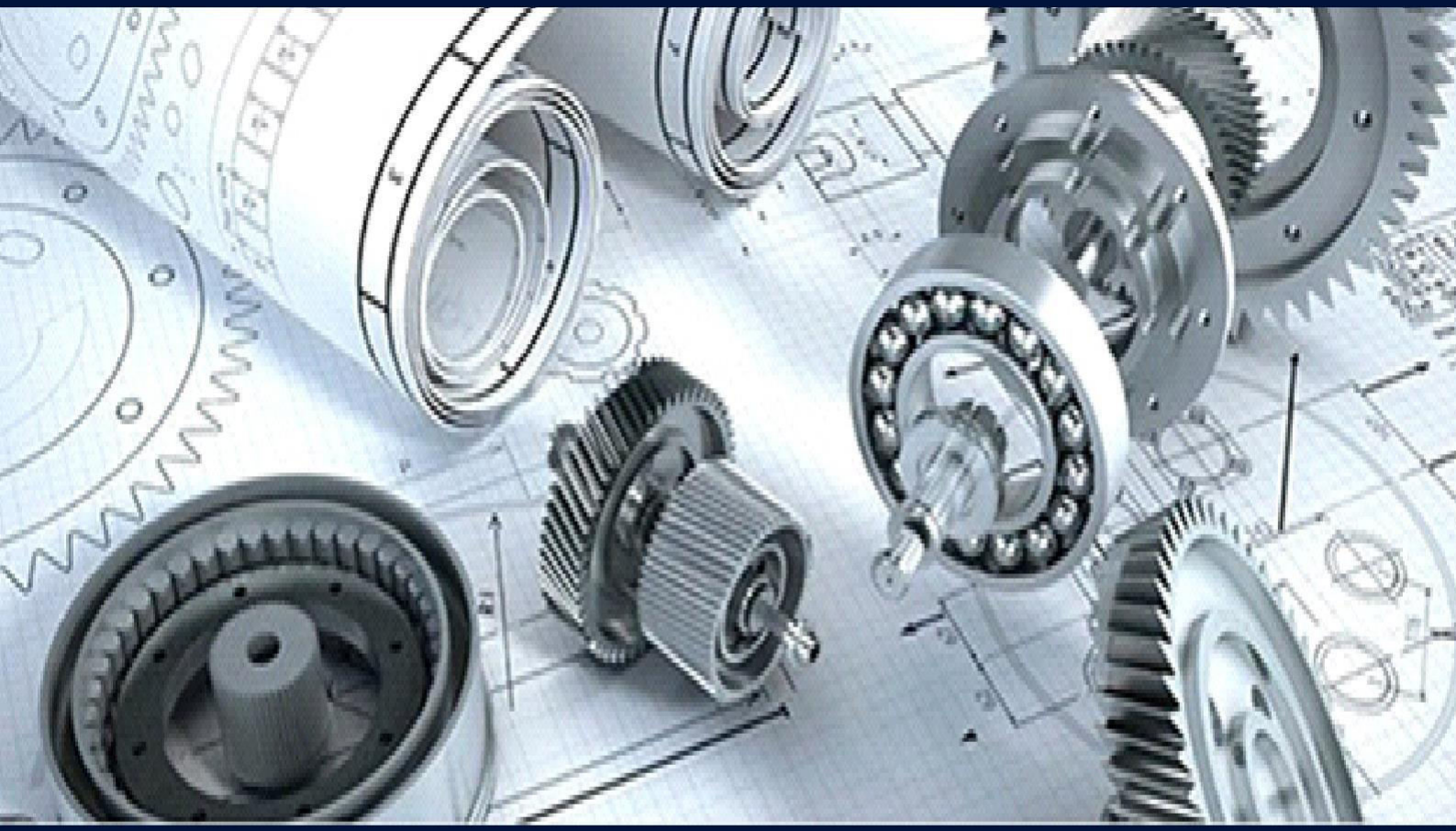

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