EXPRESSION OF INTEREST (EOI)

INVITATION FOR SELECTION OF AGENCIES TO CREATE 2D, 3D ANIMATION VIDEOS AND DIGITAL CONTENT FOR TRADES OF INDUSTRIAL TRAINING INSTITUTE (ITI) UNDER CTS SCHEME, MSDE, GOVERNMENT OF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE

Issued By
National Instructional Media Institute
Ministry of Skill Development & Entrepreneurship, Government of India
CTI Campus, Guindy Industrial Estate, Guindy, Chennai – 600032
https://nimi.gov.in
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Disclaimer

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Submission of proposal under EOI mode doesn't guarantee evaluation or allocation of work. Under no circumstances will the NIMI be held responsible or liable in any way for any claims, damages, losses, expenses, costs or liabilities whatsoever (including, without limitation, any direct or indirect damages for loss of profits, business interruption or loss of information) resulting or arising directly or indirectly by application or non – application to this EOI.

Abbreviations

CTS	Craftsman Training Scheme
EOI	Expression of Interest
ICT	Information and Communications Technology
ISO	International Organization for Standardization
IT	Information Technology
ITOT	Institute of Training of Trainers
LMS	Learning Management System
MCQ	Multiple Choice Question
MSDE	Ministry of Skill Development & Entrepreneurship
NCVET	National Council for Vocational Education and Training
NIMI	National Instructional Media Institute
NSDC	National Skill Development Corporation
NSQC	National Skills Qualifications Committee
NSQF	National Skills Qualifications Framework
NSTI	National Skill Training Institute
PSU	Public sector undertaking
EOI	Request for Proposal
SCORM	Sharable Content Object Reference Model
SME	Subject Matter Expert

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1. INTRODUCTION

National Instructional Media Institute (NIMI) was set up in the name of Central Instructional Media Institute (CIMI) in Chennai in December 1986 by the Government of India as a Subordinate Office under Directorate General of Employment and Training (DGE&T) with the assistance from Government of Germany through GTZ (German Agency for Technical Co-operation) as the executing agency.

After the approval of the Cabinet for the Grant of Autonomous status to CIMI, the Institute was registered as a society on 1st April 1999 under the Tamil Nadu Societies Registration Act 1975. Since then, it is functioning as an Autonomous Institute under the Govt. of India, Ministry of Skill Development & Entrepreneurship (MSDE), Directorate General of Training (DGT), New Delhi.

As per the recommendation of the Governing Council in its 5th Meeting held on 29.06.2003 under the Chairmanship of the Hon'ble Union Labor Minister, the institute was renamed as National Instructional Media Institute (NIMI) to reflect its National Character.

1.1. Objective

NIMI has been functioning as a Nodal Agency to develop Instructional Materials, e-content, Question Banks, Train media developers and trainers, enable translation of books into Hindi and other reginal languages, network with other vocational stakeholders, create resource centers for vocational courses, promote research in the field of development of instructional materials and offer consultancy services.

NIMI envisages to scale global benchmarks in vocational education as a Nodal Organization for curricula, instructional media packages and Test Item development for vocational courses in the country.

NIMI proposes to accelerate vocational training in the country through systemic curriculum development, production, dissemination of instructional media packages and training on instructional media by closely interacting with the State / UT Govts., Industries, ITIs and Organizations involved in Vocational Training.

An excellent learning approach, blended learning refers to a combination of offline (traditional learning methodologies, face-to-face learning) and online learning strategies (online quizzes, discussion boards, and other resources) in perfect synchronization with each other.

Leveraging technology, educational software, and new learning tools, educators across the world are increasingly blending in-class and online learning strategies giving rise to this interesting model known as Blended Learning.

Also known as mixed or hybrid learning, this learning approach can be put to use in various forms. While some organizations prefer to use blended learning as the primary teaching method within the course curriculum, others use this technique only at specific instances.
The focus of the blended learning model is to give learners more freedom in the way that they learn and engage in their education.

1.2. Background

The Craftsman Training Scheme was introduced by government of India in 1950 to ensure a study flow of skill workers in different trades for the domestic Industries to raise quantitatively and qualitatively the Industrial production by systematic training and to nurture a technical skill and to cultivate industrial attitude in the minds of younger generation. The scheme being important in the field of vocational training has been harnessing the industry by supplying skilled workforce.

In order to make the course curriculum more interesting and easier to grasp, NIMI has proposed to develop e-learning content in the form of 2D/3D Animation of critical topics of all trade in this CTS scheme.

1.3. Definition of Terms

1.4.1. “Bidder” means any firm offering the solution(s), service(s) and /or materials required in the EOI. The word Bidder when used in the pre award period shall be synonymous with Bidder, and when used after award of the Contract shall mean the Service Provider (SP) with whom NIMI signs the agreement for providing its services.

1.4.2. “Contract” is used synonymously with Agreement

1.4.3. “Document” means any embodiment of any text or image however recorded and includes any data, text, images, sound, voice, codes, databases or any other electronic documents as per IT Act 2000.

1.4.4. “Effective Date” means the date on which this contract is signed

1.4.5.“Intellectual Property Rights” means any patent, copyright, trademark, trade name, service marks, brands, proprietary information whether arising before or after the execution of this contract and the right to ownership and registration of these rights.

1.4.6.“NIMI” refers to National Instructional Media Institute

1.4.7.“NIMI's Representative / Project Coordinator” means the person or the persons appointed by the designated authority from time to time to act on its behalf for overall coordination, supervision and project management.

1.4.8.“SP” means Service Provider which has to provide services to NIMI as per the scope of work of in this EOI.

1.4.9. “Scope of Work” means all Goods and Services, and any other deliverables as required to be provided by the SP under this EOI.

1.4.10.“SP’s Team” means Agency’s team, who has to provide Goods & Services to the designated authority under the scope of this EOI. This definition shall also include any and/or all of the employees/ individuals engaged either directly or indirectly by SP.

1.4.11.“Timelines” means the project milestones for performance of the Scope of Work and delivery of the Services as described in the EOI.

1.4.12. “Terms of Reference (ToR)” and “Scope of Work (SoW)” used synonymously mean all Goods and Services, and any other deliverable as required to be provided by the selected bidder (SB) under this EOI.

1.4.10."Technically Qualified/ Technical Qualification" is synonymous to eligible bidders who have been shortlisted through this EOI and qualified to participate in the subsequent EOI process

1.4. Bidding Data Sheet

S.no	Particulars	Details
1.	Document ID	NIMI/MS/T-11022/MM/2022
2.	Release date	14.10.2022
3.	Selection Method	• **Prequalification and Technical Evaluation –** Meeting minimum eligibility criteria as per prequalification evaluation matrix set forth in the 'Expression of Interest' or EoI. • Further Bidder will be shortlisted based on Technical Evaluation whose already pre-qualified as per prequalification evaluation matrix • If a bidder is not qualified as per pre-qualification evaluation matrix. The bid will be rejected, and the technical bid will not opened.
4.	Name of the Client / EOI issued by	National Instructional Media Institute (NIMI)
5.	Key Client Personnel	The Executive Director National Instructional Media Institute Ministry of Skill Development and Entrepreneurship Government of India Post Box No. 3142, CTI Campus, Guindy Industrial Estate, Guindy, Chennai-32
6.	Availability of EOI	EOI can be downloaded from www.nimi.gov.in
7.	Last Date for Receiving Pre-bid Queries	All bid related queries shall be shared via E-mail on chennai-nimi@nic.in latest by 19.10.2022 Subject of pre-bid query emails should be "Pre-bid Queries – Blended Content Development EOI - <<Name of Bidder>>"
8.	Pre-bid Meeting	Pre-bid Meeting shall be conducted on 21.10.2022, 11:00 hrs at National Instructional Media Institute Ministry of Skill Development and Entrepreneurship Post Box No. 3142, CTI Campus, Guindy Industrial Estate, Guindy, Chennai-32 and via VC (Video Conferencing)
9.	Response to pre-bid Queries	NIMI shall respond to pre-bid queries within 3 working days from the Pre-bid Meeting
10.	Last Date of Submission of the Proposal	Proposals must be submitted within 21 days from publishing of the EOI i.e., 15.00 hrs on 04.11.2022. Any proposal received after submission deadline shall be deemed as disqualified and shall be returned unopened

11.	Validity of Bids	Bid shall be valid for a period of 180 days from the lastdate of proposal submission
12.	Ernest Money Deposit (EMD)	All proposals submitted in response to the EOI document must be accompanied by an EMD of INR 1,50,000 in form of Demand Draft issued in favor of The Executive Director, National Instructional Media Institute, Payable at Chennai. Validity shall be as per validity of the bid.
13.	Opening of Technical Bid	The Technical Bid shall be opened by NIMI within 10days from the submission last date of submissionof proposal. The same shall be done in presence ofinternal evaluation committee constituted by NIMI.
14.	Letter of Award (LOA)	NIMI shall communicate the Bidders those shortlisted within 10 days of opening of bid. Same shall be followed by subsequent talks betweenbidders and NIMI and LOA.
15	Performance Bank Guarantee (PBGA)	The selected agency(ies) shall submit Performance Bank Guarantee amounting to 10% of the contract value

2. INSTRUCTION TO BIDDERS

2.1. General Instructions

2.1.1. No Bidder shall submit more than one Bid for the Project. Bid shall be valid for a period of 180 days from the last date of proposal submission.

2.1.2. Bidders are advised to study all instructions, forms, terms, requirements, and other information in the EOI documents carefully. Submission of the bid shall be deemed to have been done after careful study and examination of the EOI document with full understanding of its implications.

2.1.3. Failure to comply with the requirements of this paragraph may render the Proposal noncompliant and the Proposal may be rejected. Bidders must –
(a) Include all documentation specified in this EOI
(b) Follow the format of this EOIEOI and respond to each element in the order as set out in this EOI
(c) Comply with all requirements as set out within this EOI.

2.1.4. Consortium/ Joint Venture and Associations are not allowed as a part of this EOIEOI. Any proposal of said nature received by NIMI shall be considered as non-compliant and will not be evaluated or considered by NIMI.

2.1.5. Subcontracting is not permitted under this EOI. The bidder shall not do subcontracting of any work whatsoever at any stage under the EOI, including the delivery phase post selection.

2.1.6. From the time of bid advertisement to the time of Contract award, if any Bidder wishes to contact the NIMI (or designated officer) on any matter related to the bid, it should do so in writing at the address mentioned in bidding data sheet.

2.1.7. The bidder shall bear all costs associated with the preparation and submission of its Bid, and the NIMI shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

2.1.8. Bidders should submit only one Bid including Technical Bid and EMD separately sealed/ attached/ enclosed and named appropriately for identification

2.1.9. The bids shall remain valid for the period of 180 days from the date of opening of the technical bid.

2.1.10. In exceptional circumstances, prior to the expiration of the bid validity period, NIMI may request bidders to extend the period of validity of their bids. In case of bidder extending the bid, the Bidder granting the request shall also extend the bid security/EMD adequately beyond the deadline of the extended validity period.

2.2. Pre-bid Meeting and Clarifications

2.2.1 Pre-bid Meeting shall be conducted on 21.10.2022, 11:00 hrs at National Instructional MediaInstitute Ministry of Skill Development and Entrepreneurship Post Box No. 3142, CTI Campus, Guindy Industrial Estate, Guindy, Chennai-32 and via VC (Video Conferences)

2.2.2 The Bidders will have to ensure that their queries for Pre-Bid meeting should reach NIMI via. email sent to 19.10.2022,17:00 hrs. The queries should have reference to relevant sections of the EOI wherever applicable.

2.2.3 NIMI shall not be responsible for ensuring that the bidders' queries have been received by them. Any requests for clarifications after the indicated date and time may not be entertained by the NIMI.

2.2.4 NIMI will endeavor to provide timely response to all queries. However, NIMI makes no representation or warranty as to the completeness or accuracy of any response; neither response nor does NIMI undertake to answer all the queries that have been posed by the bidders. The responses to the queries from all bidders will be distributed to all.

2.2.5 At any time prior to the last date for receipt of bids, NIMI may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the EOI Document by a corrigendum.

2.2.6 The Corrigendum (if any) & clarifications to the queries from all bidders will be posted on the www.nimi.gov.in and emailed to all participants of the pre-bid conference. Any such corrigendum shall be deemed to be incorporated into this EOI.

2.2.7 In order to provide prospective Bidders reasonable time for taking the corrigendum into account, NIMI may, at its discretion, extend the last date for the receipt of Proposals.

2.3. EMD

2.3.1 All proposals submitted in response to the EOI document must be accompanied by an EMD of INR 1,50,000 in form of Demand Draft issued in favor of The Executive Director, National Instructional Media Institute, Payable at Chennai. The same shall be valid for the entire bid validity period of 180 days.

2.3.2 Any bid NOT accompanied by an enforceable and compliant bid security (EMD) shall be rejected by the NIMI as non-responsive.

2.3.3. EMD of the unsuccessful Bidder shall be returned as promptly as by NIMI. The EMD, for the amount mentioned above, of successful bidder would be returned upon submission of Performance Bank Guarantee as per the format provided in Annexures section 5.7.

2.3.3 The EMD will be forfeited by NIMI on account of one or more of the following reasons

(a) If a bidder withdraws its bid during the period of bid validity

(b) If the successful bidder fails to sign the contract in accordance with terms and conditions

2.4. Bid Submission

2.4.1 The EOI shall be submitted in a single sealed envelope superscripted with "Expression of Interest (EOI) for Blended Learning Content Development" and bidder's name. This outer envelope should contain Technical Proposal and EMD in two separate envelopes. Also, one soft copy of the Technical Proposal only in the form of DVD/CD/USB shall be provided in the Technical Proposal Envelope.

2.4.2 NIMI will not be held responsible if the submitted technical proposal bid is damaged or unreadable. If the DVD/CD/USB submitted by the firm is damaged or unreadable the firm will automatically be disqualified.

2.4.3 EOI responses shall be submitted in the following manner –

(a)Technical Proposal - (1 Original + Soft Copy of Technical Proposal in CD/USB) in first envelope

(b) EMD (1 Original) in second envelope

All the above shall be placed in an outer envelope.

2.4.4 Proposals must be submitted within 21 days from publishing of the EOI i.e., latest by 15:00 hrs on 04.11.2022 to The Director, National Instructional Media Institute Ministry of Skill Development and Entrepreneurship, Post Box No. 3142, CTI Campus, Guindy Industrial Estate, Guindy, Chennai-32

2.4.5 Technical Proposal shall consist of supporting proofs and documents as defined in Section 5 (Annexures) of the EOI. Bidder shall submit all the required documents

as per format mentioned in the Section 5 of this EOI document.

2.4.6 Conditional bids are liable to be rejected.

2.4.7 NIMI shall not be responsible for delay or non-receipt of the documents/bids. Any proposal received after submission deadline shall be deemed as disqualified and shall be returned unopened.

2.4.8 All the pages of the proposal must be sequentially numbered and must contain the list of contents

2.4.9 The original proposal/bid shall contain no interlineations or overwriting, except as necessary to correct errors made by the bidder itself. Any such corrections must be initialed by the person (or persons) who sign(s) the proposals.

2.4.10 All pages of the bid including the duplicate copies, shall be initialed and stamped by the person or persons who is authorized to sign the bid.

2.4.11 In case of any discrepancy observed by NIMI in the contents of the submitted original paper bid documents with respective copies, the information furnished on original paper bid document will prevail over others.

2.4.12 Bidder must ensure that the Technical Proposal Copy furnished by bidders in respective USB or DVDs/CDs is identical to that submitted in the original paper bid document. In case of any discrepancy observed by NIMI in the contents of the USB or DVDs/CDs and original paper bid documents, the information furnished on original paper bid document will prevail over the soft copy.

2.4.13 The Proposal should be accompanied by a power-of-attorney in the name of the signatory of the Proposal.

2.4.14 The bidder shall be responsible for all costs incurred in connection with participation in the EOI process, including, but not limited to, costs incurred in conduct of informative and other diligence activities, participation in meetings/discussions/presentations, preparation of proposal, in providing any additional information required by NIMI to facilitate the evaluation process, and in negotiating a definitive contract or all such activities related to the bid process.

2.4.15 NIMI will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

2.4.16 The Proposal should be filled by the Bidder in English language only. If any supporting documents submitted are in any language other than English, translation of the same in English language is to be duly attested by the Bidders. For purposes of interpretation of the Proposal, the English translation shall govern.

2.4.17 The offer submitted by the Bidders should be valid for minimum period of 180 days from the date of submission of bid.

3. BID OPENING AND EVALUATION

3.1. Pre-qualification Criteria and Evaluation Matrix:

Following criteria prescribed as the Pre-Qualification Criteria/ Evaluation Matrix for bidder interested in undertaking the project shall be applicable. The bidder shall fulfill all the following preconditions and must also submit documentary evidence in support of fulfillment of these conditions while submitting the EOI response. Claims without documentary evidence will not be considered.

Besides the mandatory criteria certain evaluative criteria have been defines basis which each bidder EoI shall be evaluated and ranked in order of highest to lowest.

S.No.	Basic Requirements	Specific Requirements	Documents to be submitted along with EOI	Marks Allocation	obligate
1.	Legal Entity	The bidder must be an Indian firm/ agency/organization and must be legally registered under appropriate authority in India. The firm must be registered under GST Act 2017.	i. Copy of Certificateof Incorporation and Copy ofMemorandum ofAssociations (MOA), Articles ofAssociation (AOA) ii. GST Registration Copy iii. PAN Card copy	5 Marks	Mandated
2.	Turnover	The bidder should have minimum annual average turnover of INR 50 Lakh exclusively from e-learning / digital content development and related work during the last three financial years (i.e. 2019-20, 2020-21 and 2021-22)	i. Certificate from the Chartered Accountant ii. Copies of audited balance sheet, profit & loss accounts for last three consecutive financial years (i.e. 2019-20, 2020-21 and 2021-22)	5 Marks	Mandated
3.	Financia l Strength	Bidder should have **positive Net Worth for the last three financial years** (i.e. 2019-20, 2020-21 and 2021-22)	Certificate from the Chartered Accountant for Positive Net Worth	5 Marks	Mandated
4.	Infrastructure	The bidder should haveregistered office in India.	i. Registration Certificate of theregistered office from authorities or relevant Govt. department.	5 Marks	Mandated
5.	Non-Blacklisting	The Bidder should not be blacklisted by any law-and-order agency, with any of the Government (Centralor State), PSU or Public- private Partnership (PPP).	Self-Declaration Letter duly signed byauthorized signatoryon company letter head and notarized as per format given inSection 5, Form-D of this EOI	5 Marks	Mandated

6.	Experience Overall	The bidder must have minimum 5 years of experience in making Video, Concept Creation Visual Storyboard, ArtworkVoiceover for English, Hindi, Location shoot direction including interviews, DOP, Camera Equipment, Lighting,Motion graphics, VFX Filmediting, Buying of Royalty, Free Stock Footage, Images if any.	i. Experience certificate/letterfrom engagingbody/Contract Document clearly indicating total experience in years ii. Summary ofassignments listedshall be provided in enclosed format along withsupporting such as Contract, Letter of Engagement, Letter of Completion/ Acknowledgement or equivalent	10 Marks	Mandated
7.	In-House Production Facilities	The agency must have in- house production facilitiesfor production and editing of contents in all forms including video in highdefinitions, research based technical content etc.	Picture or video samples of your in- house facility in a CD/DVD/USB	5 Marks	Mandated
8.	Experience in development of Videos	Bidder should have capabilities to develop anykind of videos (Shoot based, 2D animation, 3D animation, stockimages/videos based etc.)with voice along with music including but not limited to original music; for various requirements applicable to product ads, tutorials, launch videos, occasion-based videos, digital content video, etc. depending on the need and requirement raised by the Bank. Marks will be given on criteria like Storyline Graphics/voice over/Music/Presentation and Overall Impact	Work Sample in CD/DVD/USB Firm should submitvideo content in Engineering and non-Engineering subjects	20 Marks Engineering Content – 10 Marks Non - Engineering content – 10 Marks Dubbed into regional Language – 5 Marks	Mandated
9	Experience of working with government Organizations	The bidder should have minimum 3 years of relevant experience with Government Organizations.	Declaration by Authorized Signatory along with the Work order showing the date of award along with current contact details of the client	5 Marks	Mandated
10	Employees on Payroll	Bidder should possess the requisite human resource capabilities. i.e. minimum 50 professionals working in the area of video production/quality	Letter form HR head Mentioning the total number of employees (Regular/Contractual) along with the names of employees.	5 Marks	Mandated

11	Certification	ISO or CMMI Certification Relevant	Copy of such certificates clearly Indicating the validity	5 Marks	Mandated
			Total	**100**	

3.2. Opening and Evaluation of the Technical Bid

3.2.1. The Bidder should submit the Blended Learning e-content based on the lesson content along with the scope of work given by NIMI. They should develop the Blended Learning e-content considering the parameters given in the scope of work.

3.2.2. NIMI will constitute an internal Proposal Evaluation Committee to evaluate the responses (Blended Learning e-content) of the bidders, the decision of the Proposal Evaluation Committee in the evaluation of responses to the EOI shall be final. No correspondence will be entertained outside the process of evaluation with the committee.

3.2.3. The Proposal Evaluation Committee reserves the right to reject any or all proposals on the basis of any deviations. Each of the responses shall be evaluated as per the criterion and requirements specified in this EOI.

3.2.4. The Technical Proposals submitted up to last date and time of submission as per the bidding data sheet will be opened at NIMI Office, CTI Campus, Guindy, Chennai within 10 days from submission of proposal in presence of NIMI Committee Members, those Bidders or their representatives who may be present at the time of opening

3.2.5. For timely evaluation of the bids, the NIMI Evaluation Committee may, at its discretion, seek any clarification from bidders with regards to technical proposal and related supporting documents submitted by the bidders.

3.2.6. If the Bidder does not provide clarifications about its bid by the date and time set in the NIMI's request for clarification, the bids shall be evaluated on the basis information available with the NIMI.

3.3. Evaluation and Selection Methodology

3.3.1. NIMI will prepare a list of responsive bidders, who comply with all the Terms and Conditions of the EOI. All eligible bids will be considered for further Technical bid evaluation by the NIMI Proposal Evaluation Committee according to the Evaluation process defined in this EOI document. The decision of the Committee will be final in this regard.

3.3.2. The Proposal Evaluation Committee shall evaluate the compliant bids and rank them in order of their Technical Score with highest Technical Scoring bidder termed as T1, followed by T2, T3 and T4.

3.4. Evaluation Matrix for Technical Bids

S.no	Parameters	Grades/Marks
1.	Coverage of practical and theory topic	**12**
	• Factual accuracy of facts explanation, representations and terminologies.	3
	• Alignment of skills coverage with recommendation of NSQF	3
	• Provided Real life examples	3
	• Inclusivity of diverse learners i.e gender, race, socio-economic background, appearances.	3
2.	Storyboard (as per the given format)	**8**
3.	3D Animation	**25**
	• 3D Model	5
	• Lighting	5
	• Animation	5
	• Rendering	5
	• Material	5
4.	2D Animation	**20**
	• 2D Motion graphic	7
	• 2D Model	7
	• 2D Image (Tracing, Drawing)	6
5.	Video	**15**
	• Presenter	3
	• HD Video	3
	• VFX (Green Screen, etc)	3
	• Voice Sink	3
	• Editing & Continuity	3
6.	Voice & Background Music (0 if Meachine voiced is used)	**10**
	• Quality of the Audio	3
	• Background Music	2
	• Usage of English to present skill terms & operations with vernacular accent toacquaint leaners with the language.	5
7.	Regional Language (Tamil or Hindi)	**5**
	• Quality of the Audio	2.5
	• Comprehensibility of vocabulary and accent used, for the intended learners	2.5
8.	MCQs	**5**
	• Choose	1
	• Drag and Drop	1
	• Game	1
	• Correctness, clarity and ambiguity of assessment question and their solutions	2
Total		**100**

3.4.1. The Bidder must meet minimum requirement on all criteria and must obtain minimum Technical Score of 40 out of Maximum Technical Score of 100.

3.5. Notification of Award and Contract Signing

3.5.1. NIMI reserves the right to accept or reject any proposal, and to annul the tendering process/Public procurement process and reject all proposals at any time prior to award of contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders of the grounds for its action.

3.5.2. Prior to the expiration of the bid validity period, NIMI will notify the successful bidder(s) in writing or via email, that their proposal has been accepted. In case the tendering process/public procurement process has not been completed within the stipulated period, NIMI, may request the bidders to extend the validity period of the bid.

3.5.3. The notification of award will constitute the formation of the contract. Upon the successful bidder's furnishing of Performance Bank Guarantee, NIMI will notify each unsuccessful bidder and return their EMD.

3.5.4. The NIMI will require the selected bidder to provide a Performance Bank Guarantee, within 15 days from the Notification of award, for a value equivalent to 10% of the contract value. The Performance Guarantee should be valid for entire duration of the contract.

3.5.5. The Performance Guarantee shall be kept valid till completion of the project or contract i.e. till the final deliverable are signed off by NIMI. The Performance Guarantee shall contain a claim period of three months from the last date of validity. The selected bidder shall be responsible for extending the validity date and claim period of the Performance Guarantee as and when it is due on account of non-completion of the project or any delays whatsoever.

3.5.6. NIMI shall reserve the right to negotiate with the bidder(s) whose proposal has been most responsive. On this basis the draft contract agreement would be finalized for award & signing.

3.5.7. NIMI may also like to reduce or increase the quantity of any item in the Scope of Work defined in the EOI. Accordingly, total contract

3.5.8. After NIMI notifies the successful bidder(s) that its proposal has been accepted, NIMI shall enter into a contract, incorporating all clauses, pre-bid clarifications and the proposal of the bidder between NIMI and the successful bidder(s).

3.5.9. Failure of the successful bidder(s) to agree with the Draft Legal Agreement and Terms & Conditions of the EOI shall constitute sufficient grounds for the annulment of the award, in which event NIMI may award the contract to the next best value bidder or call for new proposals from the interested bidders. In such a case, NIMI shall invoke the PBG of the most responsive bidder.

4. TERMS OF REFERENCE

4.1. Objective

4.1.1. NIMI has been functioning as a Nodal Agency to develop Instructional Materials, e-content, Question Banks, translation of books into given regional languages , promote research in the field of development of instructional materials and offer consultancy services.

4.1.2. NIMI envisages to scale global benchmarks in vocational education as a Nodal Organization for curricula, instructional media packages and Test Item development for vocational courses in the country.

4.1.3. NIMI proposes to accelerate vocational training in the country through systemic development of instructional media packages and by closely interacting with the State / UT Govts., Industries, ITIs and Organizations involved in Vocational Training.

4.1.4. An excellent learning approach, blended learning refers to a combination of offline (traditional learning methodologies, face-to-face learning) and online learning strategies (online quizzes, discussion boards, and other resources) in perfect synchronization with each other.

4.1.5. Leveraging technology, educational software, and new learning tools, educators across the world are increasingly blending in-class and online learning strategies giving rise to this interesting model known as Blended Learning.

4.1.6. Also known as mixed or hybrid learning, this learning approach can be put to use in various forms. While some organizations prefer to use blended learning as the primary teaching method within the course curriculum, others use this technique only at specific instances.

4.1.7. The focus of the blended learning model is to give learners more freedom in the way that they learn and engage in their education

4.2. Scope of Work

4.2.1. NIMI intends to develop blended learning content for five (5) CTS courses through this EOI. These courses include Electrician, Fitter, Welder, Mechanic Diesel, Cosmetology and/or other different trades in First phase further courses will be added after completion of this courses.

4.2.2. The firm should engage a Subject Matter Experts and Instructional Designers in order to get the best result.

4.2.3. Production of e-Learning Videos (2D Motion Graphic, 3D animation, real time shooting) in English, Hindi, Tamil, Telugu, Malayalam, Kannada, Marathi, Bengali and Panjabi in digital format which should not be more than 60 minutes' duration. They should be sequenced into separate smaller sub-topics should not be more than

10 minutes each and have relevant activities associated with them. Each Subtopics should have 5 MCQs.

4.2.4. The e-learning material should cover 100% of the practical content and only the Important theory content should be added.

4.2.5. The firm should follow the storyboard format submitted by NIMI.

4.2.6. The video time brake up of the blended learning content with-in the video would be as follows:

i) 2 Minutes of Presenter video delivering the lecture
ii) 5 Minutes of 2D motion graphic
iii) 3 Minutes of 3D Animation

The timing can be changed based on the learning outcome and the needs of the exercise. NIMI has the right to modify the timing and remove any component in the submitted storyboard.

4.2.7. The submitted storyboard should be in MS word format, and it should clearly describe the details describes the video, 2D Motion Graphic, 3D Animation, on screen text and image description, with approximate time (in minutes) of the Video.

4.2.8. The e-content should have Introduction, Title, Learning Objectives, Subject, Real Life examples, MCQs (will be provided by NIMI). Recap. The above should be mentioned clearly on the storyboard

4.2.9. The firm should finalize the rate at the time of approving the storyboard base on the parameters mentioned.

4.2.10. Resolution of the videos are of the following format: - FHD Format: 1920x1080 or 4K

4.2.11. The firm should only start the development of the project only after approval of the storyboard.

4.2.12. The firm should follow the design document strictly produced by NIMI

4.2.13. Pedagogical alignment

4.2.13.1 The e-content should not be the replica of the given book.

4.2.13.2 The e-content should enable learners to construct their own understanding about the topic by meaningfully connecting the content to what they already know and apply it to various problem-solving scenarios.

4.2.13.2 Real-life connection should be provided to context of the learner, to help them construct the correct mental mode of the concept.

4.2.13.2 The e-content should be inviting the participation of the learner in the learning process via presentation of the content with meaningful visual organizers and explanations in conversational forms.

4.2.13.2 The e-content should have motivational features that promote learners to in trace with the content and explore it.

4.2.13.2 The e-content should be segmentation of multimedia content meaningfully such that they are sequenced into separate smaller sub-topics and have relevant activities associated with them.

4.2.13.2 The smaller sub-topics should have MCQ's aligned at corresponding cognitive levels ensuring the learning objectives.

4.2.13.2 The MCQs should have constructive feedback designed to inform learners what is wrong, why it is wrong and what should be done to refine their understanding.

4.2.13.2 The e-content should have dynamic adaptability of the assessment and content to the needs of the leaners bases on their profile, interaction and performance.

4.2.14. Technology and design alignment

4.2.14.1 The e-content should be user center principles of interaction design for Visibility, Affordance, Consistency and Mapping.

4.2.14.2 The e-content should help the learners to understand the consequence of an action.

4.2.14.3 The e-content should give adequacy of control given to learners over their learning trajectory.

4.2.14.4 The e-content should adherence to universal design so that it caters to learners with various learning challenges and physical needs.

4.2.14.5 The e-content should have meaningfulness of interactive features for the content being learned.

4.2.14.6 The e-content should map the visualization type used to the content being thought.

4.2.15. The Agencies/ Bidders must consider the following parameters while submitting technical bid:

4.2.15.1 Pre-production, shooting and editing, postproduction recording music and professional voice-over.

4.2.15.2 The Bidder's production team will be totally responsible for required infrastructure to shoot the video besides, processing, hiring of camera & lights, other equipment, studio hiring, site selection and procuring all the necessary permission for shoot, catering, transportation, etc. in case of outdoor shooting.

4.2.15.3 Agency/Bidder will be responsible for hiring the crew including, SME, Instruction Designer, Project Manager/Art Director, Videographer, animator etc.

4.2.15.4 Agency/Bidder will be responsible to meet the post-production charges such as: Studio hire for editing charges, Motion graphics Animation charges, Music composition and voice-over charges (English and given regional languages in section 4.2.3), SME, Instruction Designer and any other related charges.

4.2.15.5 Story Boarding: The bidder shall prepare the e learning video, based on the content to be discussed and provided by NIMI.

4.2.15.6 The firm should be responsible for Visual Storyboard & Artwork, Voice-over for English & Regional Languages, DOP, Camera Equipment, Lighting, Motion graphics, VFX, Film editing and Buying of Royalty, Free Stock Footage, Images if any.

4.2.15.7 Video must be well lighted and sharp images should be there. The shoot site should be clean, and objects shown in the video should be presentable. Re video shoot may be required if the videos made by the bidder is found unsatisfactory to NIMI.

4.2.15.8 Animation: The e-learning video shall include 2D Animation, 2D Motion Graphic, 3DAnimation, Panoramic, Bird's eye view of NIMI content for blended learning activities where ever required.

4.2.15.9 Editing: Editing is to be done in digital non-linear set up with graphics and animation workstation in addition to music and narration. Use of special effects shall be done in the video wherever required. Re-editing may be required if the editing made by the bidder is found unsatisfactory to NIMI. The listed scope of work is indicative only and the bidder may discuss further details with NIMI for developing the video.

4.2.15.10 Each video would have a minimum of 5 MCQ's, these MCQ's would need to be provided at the end of each exercise. It can be in the format of drag and drop, game,etc.

4.2.15.11 Inspection: The bidder shall arrange for inspection of the job by the competent authorities of NIMI on every stage of work as detailed made at any time during the process of development of the Video, if felt necessary by the competent authorities of NIMI. Any defect pointed out/ modification suggested during

such inspections must be promptly rectified/ incorporated to ensure desired quality of work. It would be mandatory on the part of the bidder to arrange inspection and obtain approval at every stage of the work, failing which action shall be taken as will be deemed fit by NIMI. The decision of NIMI in this regard shall be final and binding on the bidder.

4.2.15.12 The bidder must submit all source file created for e-learning material to NIMI.

4.2.15.13 The bidder shall agree to carry out any additional assignment/tasks during the assignment period as per instruction of NIMI, the remuneration and change request will be arrived upon by mutual agreement of the scope of work.

4.2.15.14 The Bidder/Agency shall agree to carry out any technical problems related to LMS or uploaded video content and rectify it swiftly up to six months after uploading the e-learning content in Bharat skills website.

4.2.15.15 The Firm should submit all the documents related to the development of this e-learning content to NIMI after completing of the projects. i.e. All the Source Files, Video, Audio, Images etc for future use.

4.3. Key Features of Digital Content Developed

This section details out some of the key features of the proposed digital content. The content developer needs to integrate the following points while developing e-learning content:

4.3.1. Language of Content- Content for CTS courses shall be developed in English and given Regional Language in Section 4.2.3. For the text, charts, graphics etc. of the content, clear and simple language should be used. There should be provision for addition of subtitles in one or more languages for all the video/ digital content developed.

4.3.2. The video and audio content developed should be of professional standard as defined by NIMI and SME's

4.3.3. NSQF Alignment- All the content developed will be basis textbooks developed by NIMI and the same is mapped to the National Skills Qualifications Framework (NSQF). The selected agency shall ensure that the NSQF alignment requirements of the blended content developed are met at all times.

4.3.4. Modular Structure of content- The content to be designed as discrete components within the content whole. In other words, module-wise content should be created for each course defining weekly lesson plans (including reading, assessments, assignments etc.)

4.3.5. Multi-device and Platform Compatibility- The e-content should have cross platform compatibility (i.e. Android, Windows, Black berry, iOS etc.) and compatibility with

major browsers (i.e. Internet Explorer, Mozilla Firefox, Google Chrome, etc.). It should also be accessible on open User Interface (UI).

4.3.6. Sharable Content Object Reference Model (SCORM) standards- The content is to be SCORM packaged with latest/acceptable version to enable integration, hosting, and functioning of courses on the Learning Management System (LMS) such as Bharat Skills.

4.3.7. Compatibility with LMS - The e-content to be made compatible with LMS (i.e. Bharat Skills) and Moodle platform for capturing learning progress of the users and being responsive to assessments and learning analytic module-wise, course-wise etc. The use of new tools such as natural language processing (NLP) techniques can further be explored to enable parsing and stemming of text data and identify the correlated topics.

4.3.8. Compatibility toward easy translation to other languages- The construction of the Regional Languages/English language e-content need to be clear, simple, and unambiguous so that it is easier to translate the content in any other Indian/regional language, whenever required.

4.3.9. Copyrights and Intellectual Property- The content developer shall warrant that there is no infringement of any patent or intellectual property rights caused by the development/conversion of e-contents which are subject matter of this project. NIMI will own the copyright in all deliverable materials created under the project. The content developer shall transfer Intellectual Property Rights (IPR) of all products developed/enhanced/ modified/ configured under this project to the NIMI.

4.3.10. Plagiarism checks - shall be performed to ensure that the content developed is based on NIMI textbooks only and the digital content created by agency has not been copied from elsewhere.

4.3.11. Do not use any brand image or logo or any material related to your firm or any other firm in the e-learning content other than NIMI.

4.3.12. Firm should submit the final content in the SCROM, HD MP4, HTML 5, Compressed MP4 (should be sharable on social media) Formats.

4.4. Resource Sharing

4.4.1. NIMI will provide comprehensive textbooks along with curriculum for all the courses to be developed, these textbooks will serve as source for all digital content to be developed.

4.4.2. For tutorial and practical videos to be shot in industries the vendor shall make necessary arrangements; NIMI may issue request letters in this regard to industries, if required.

4.4.3. NIMI will Share the storyboard template.

4.5. Timelines

As time and quality are essence of the content development, the content developer needs to strictly adhere to the time schedules specified below:

S. No	Action Item	Timeline
1.	Development of Storyboard	$T_0 + T_{30}$
2.	Approval of Storyboard form NIMI	$T_{31} + T_{46}$
3.	Development of Rough-cut (Rough animation)	$T_{47} + T_{62}$
4.	Approval of Rough-cut (Rough animation)	$T_{63} + T_{73}$
5.	Development of Blended learning	$T_{74} + T_{133}$
6.	Submission of Multi-Lingual Script and approval of final Blended learning	$T_{134} + T_{144}$
7.	Submission and uploading in portal	$T_{145} + T_{150}$

The abovementioned timeline is outer limit/ maximum duration for each activity and NIMI reserves the right to levy penalty if the blended learning content is not developed to the NIMI's satisfaction or within the project's time frame or both, as the case may be.

4.6. Copy right

- The developed video will be the sole property of NIMI. The bidder under no circumstances will sell, lease, use, lend or donate the videos, wholly or partly, to any other client.

- The e-learning content developed by bidder should not violate any copy right. If violated the bidder will be solely responsible for legal action.

4.7. Payment Milestones

S.no	Stages	Payment Option
1.	Approval of Storyboard form NIMI	20%
2.	Approval of Rough-cut (Rough animation)	20%
3.	Approval of Final Blended learning	30%
4.	Approval of Multilingual Script and Submission and uploading in Bharath Skill portal &After submission of all the source files.	30%

5. ANNEXURES

5.1. FORM - A

S. No	Years	Turnover Details (in INR)
A	2019-20	
B	2020-21	
C	2021-22	
Average Annual Turnover (A+B+C) / 3		

Signature of the applicant
Full name of Applicant and Designation
Place, Date

5.2. FORM – B

S. No.	Name of the Assignment	Name of the Client/ engaging body	Name and Address/Telephone No./email of officer to whom reference may be made	Brief description of services provided	Start Date andEnd Date	Duration of the Assignment	Value of Services Provided (in INR lakhs)

Signature of the applicant
Full name of Applicant and Designation
Place, Date

5.3. FORM – C

S.No.	Organizational Contact Details	
1	Name of Organization	
2	Primary areas of business	
3	Address of offices in i. National CapitalRegion of Delhi ii. All other State/UT's	
4	Contact person with telephone no. and Email ID	

Signature of the applicant
Full name of Applicant and Designation
Place, Date

5.4. FORM – D

SELF-DECLARATIONNON-BLACKLISTING

To,

NIMI

Dear Sir,

In response to the "Expression of Interest (EOI) for selection of agencies to create 2D, 3D animation Videos and Digital Content for trades of Industrial Training Institute (ITI) under CTS scheme, MSDE, Government of India)", I/We hereby declare that presently our company/firm (Name of the agency/ firm/ organization) is having unblemished record and is neither blacklisted nor debarred by any PSU or Any Regulatory Body or Government of India or State Government or any of its agencies for any reasons whatsoever.

If this declaration is found to be incorrect then without prejudice to any other action that may **be taken, our proposal to the extent accepted may be cancelled.**

Thanking you,

Yours faithfully,

Name of the Bidder

Authorized Signatory

Seal of the Organization

5.5. Format for sharing pre-bid queries

BIDDER'S REQUEST FOR CLARIFICATION			
<<Name of Organization submitting query / request for clarification>>			
<<Details of the concerned bidder representative sharing the pre-bid queries>>		Tel:	
		Fax:	
		Email:	
S.no	**EOI Reference (Section No. /Page No.)**	**Content of EOI requiring clarification**	**Points of clarification required**
1.			
2.			
3.			
4.			
5.			

5.6. Bidding formats for Technical Bid

Letter of Proposal

[Location, Date]

To,
The Executive Director,
National Instructional Media Institute (NIMI) Ministry of Skill Development and Entrepreneurship Government of India
CTI Campus, Guindy Industrial Estate, Guindy Chennai - 600032

Subject: Submission of proposal in response to the EOI for selection of agencies for creation of Blended Learning content for select CTS Trades (EOI Ref. No. NIMI/MS/T11022/MM/2022)

Dear Sir,

Having examined the tender documents including all Annexure the receipt of which is hereby duly acknowledged, we, the undersigned, offer to provide the services/job for in accordance with your Request for Proposal (EOI Ref. No. NIMI/MS/T11022/MM/2022) dated [18th February]. We are hereby submitting our Proposal, which includes Technical bid and EMD sealed in a separate envelopes.

We hereby declare that all the information and statements made in this Technical bid are true and accept that any misinterpretation contained in it may lead to our disqualification.

We agree to abide by all the terms and conditions of the EOI document. We would hold the terms of our bid valid as per bid validity period stipulated in the EOI document.

Our Proposal is binding upon us and subject to the modifications resulting from Contract negotiations. We understand you are not bound to accept any Proposal you receive.

Yours Sincerely,

Authorized Signatory [In full and initials]:
Name and Title of Signatory:
Name of Firm:
Address:

5.7. Format for Performance Bank Guarantee

Performance Bank Guarantee
PERFORMANCE SECURITY:

To,
The Executive Director,
National Instructional Media Institute (NIMI)
Ministry of Skill Development and Entrepreneurship
Government of India
CTI Campus, Guindy Industrial Estate,
GuindyChennai - 600032

Whereas, <name of the supplier and address> (hereinafter called "the bidder") has undertaken, in pursuance of contract no. <Insert Contract No.> dated. <Date> to provide Implementation services for <name of the assignment> to NIMI (hereinafter called "the beneficiary") And whereas it has been stipulated by in the said contract that the bidder shall furnish you with a bank guarantee by a recognized bank for the sum specified therein as security for compliance with its obligations in accordance with the contract;

And whereas we, <Name of Bank> a banking company incorporated and having its head /registered office at <Address of Registered Office> and having one of its office at <Address of Local Office> have agreed to give the supplier such a bank guarantee.

Now, therefore, we hereby affirm that we are guarantors and responsible to you, on behalf of the supplier, up to a total of Rs.<Insert Value> (Rupees <Insert Value in Words> only) and we undertake to pay you, upon your first written demand declaring the supplier to be in default under the contract and without cavil or argument, any sum or sums within the limits of Rs. <Insert Value> (Rupees <Insert Value in Words> only) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the bidder before presenting us with the demand. We further agree that no change or addition to or other modification of the terms of the contract to be performed there under or of any of the contract documents which may be made between you and the Bidder shall in any way release us from any liability under this guarantee and we hereby waive notice of any such change, addition or modification.

This Guarantee shall be valid until <Insert Date>) Notwithstanding anything contained herein:

I. Our liability under this bank guarantee shall not exceed Rs. <Insert Value> (Rupees <Insert Value in Words> only).

II. This bank guarantee shall be valid up to <Insert Expiry Date>)

III. It is condition of our liability for payment of the guaranteed amount or any part thereof arising under this bank guarantee that we receive a valid written claim or demand for payment under this bank guarantee on or before <Insert Expiry Date>) failing which our liability under the guarantee will automatically cease.

Yours Sincerely,

Authorized Signatory [In full and initials]:
Name and Title of Signatory:
Name of Firm:
Address:

Scope of Work for Technical Bid

- The firm should develop the e-learning material given by NIMI.
- The firm should engage a Subject Matter Experts and Instructional Designers in order to get the best result.
- Production of e-Learning Videos (2D Motion Graphic, 3D animation, real time shooting) in English, Hindi or Tamil in digital format which should not be more than 30 minutes' duration. They should be sequenced into separate smaller sub-topics should not be more than 10 minutes each and have relevant activities associated with them. Each Sub topics should have 5 MCQs.
- The e-learning material should cover 100% of the practical content and only the Important theory content should be added.
- The firm should follow the storyboard format submitted by NIMI.
- The video time brake up of the blended learning content with-in the video would be as follows:
  i) 2 Minutes of Presenter video delivering the lecture
  ii) 5 Minutes of 2D motion graphic
  iii) 3 Minutes of 3D Animation
  The timing can be changed based on the learning outcome and the needs of the exercise. NIMI has the right to modify the timining and remove any component in the submitted storyboard.
- The submitted storyboard should be in MS word format and it should clearly describe the details describes the video, 2D Motion Graphic, 3D Animation, on screen text and image description, with approximate time (in minutes) of the Video.
- The e-content should have Introduction, Title, Learning Objectives, Subject, Real Life examples, MCQs (will be provided by NIMI). Recap. The above should be mentioned clearly on the storyboard
- The firm should finalize the rate at the time of approving the storyboard base on the parameters mentioned.
- Resolution of the videos are of the following format: -
  FHD Format: 1920x1080 or 4K
- Pedagogical alignment
  - The e-content should not be the replica of the given book.
  - The e-content should enable learners to construct their own understanding about the topic by meaningfully connecting the content to what they already know and apply it to various problem solving scenarios.
  - Real-life connection should be provided to context of the learner, to help them construct the correct mental mode of the concept.
  - The e-content should be inviting the participation of the learner in the learning process via presentation of the content with meaningful visual organizers and explanations in conversational forms.
  - The e-content should have motivational features that promote learners to in trace with the content and explore it.
  - The e-content should be segmentation of multimedia content meaningfully such that they are sequenced into separate smaller sub-topics and have relevant activities associated with them.
  - The smaller sub-topics should have MCQ's aligned at corresponding cognitive levels ensuring the learning objectives.
  - The MCQs should have constructive feedback designed to inform learners what is wrong, why it is wrong and what should be done to refine their understanding.
  - The e-content should have dynamic adaptability of the assessment and content to the needs of the learners bases on their profile, interaction and performance.
- Technology and design alignment
  - The e-content should be user center principles of interaction design for Visibility, Accordance, Consistency and Mapping.
  - The e-content should help the learners to understand the consequence of an action.
  - The e-content should give adequacy of control given to learners over their learning trajectory.
  - The e-content should adherence to universal design so that it caters to learners with various learning challenges and physical needs.
  - The e-content should have meaningfulness of interactive features for the content being learned.
  - The e-content should map the visualization type used to the content being thought.
  - The Agencies/ Bidders must quote production charges including all charges for the following:
  - Pre-production, shooting and editing, post production recording music and professional voice-

over.

- The Bidder's production team will be totally responsible for required infrastructure to shoot the video besides, processing, hiring of camera & lights, other equipment, studio hiring, site selection and procuring all the necessary permission for shoot, catering, transportation, etc. in case of outdoor shooting.
- Agency/Bidder will be responsible for hiring the crew including, SME, Instruction Designer, Project Manager/Art Director, Videographer, animator etc.
- Agency/Bidder will be responsible to meet the post-production charges such as: Studio hire for editing charges, Motion graphics Animation charges, Music composition and voice-over charges (English and Hindi or Tamil), SME, Instruction Designer and any other related charges.
- Story Boarding: The bidder shall prepare the e learning video, based on the content to be discussed and provided by NIMI.
- Visual Storyboard & Artwork, Voice-over for English & Hindi or Tamil, DOP, Camera Equipment, Lighting, Motion graphics, VFX, Film editing and Buying of Royalty, Free Stock Footage, Images if any.
- Video must be well lighted and sharp images should be there. The shoot site should be clean, and objects shown in the video should be presentable. Re video shoot may be required if the videos made by the bidder is found unsatisfactory to NIMI.
- Animation: The e-learning video shall include 2D, 2D Motion Graphic, 3DAnimation, Panoramic, Bird's eye view of NIMI content for blended learning activities.
- Editing: Editing is to be done in digital non-linear set up with graphics and animation workstation in addition to music and narration. Use of special effects shall be done in the video wherever required. Re-editing may be required if the editing made by the bidder is found unsatisfactory to NIMI. The listed scope of work is indicative only and the bidder may discuss further details with NIMI for developing the video.
- Each video would have a minimum of 5 MCQ's, these MCQ's would need to be provided at the end of each exercise. It can be in the format of drag and drop, game,etc.
- Inspection: The bidder shall arrange for inspection of the job by the competent authorities of NIMI on every stage of work as detailed made at any time during the process of development of the Video, if felt necessary by the competent authorities of NIMI. Any defect pointed out/ modification suggested during such inspections must be promptly rectified/ incorporated to ensure desired quality of work. It would be mandatory on the part of the bidder to arrange inspection and obtain approval at every stage of the work, failing which action shall be taken as will be deemed fit by NIMI. The decision of NIMI in this regard shall be final and binding on the bidder.
- The bidder must submit all source file created for e-learning material to NIMI.
- The bidder shall agree to carry out any additional assignment/tasks during the assignment period as per instruction of NIMI, the remuneration and change request will be arrived upon by mutual agreement of the scope of work.

- **Key Features of Digital Content Developed**
  - This section details out some of the key features of the proposed digital content. The content developer needs to integrate the following points while developing e-learning content:
  - Language of Content- Content for CTS courses shall be developed in English and given Regional Language. For the text, charts, graphics etc. of the content, clear and simple language should be used. There should be provision for addition of subtitles in one or more languages for all the video/ digital content developed.
  - The video and audio content developed should be of professional standard
  - NSQF Alignment- All the content developed will be basis textbooks developed by NIMI and the same is mapped to the National Skills Qualifications Framework (NSQF). The selected agency shall ensure that the NSQF alignment requirements of the blended content developed are met at all times.
  - Modular Structure of content- The content to be designed as discrete components within the content whole. In other words, module-wise content should be created for each course defining weekly lesson plans (including reading, assessments, assignments etc.)
  - Multi-device and Platform Compatibility- The e-content should have cross platform compatibility (i.e. Android, Windows, Black berry, iOS etc.) and compatibility with major browsers (i.e. Internet Explorer, Mozilla Firefox, Google Chrome, etc.). It should also be accessible on open User Interface (UI).
  - Compatibility toward easy translation to other languages- The construction of the Regional

Languages/English language e-content need to be clear, simple, and unambiguous so that it is easier to translate the content in any other Indian/regional language, whenever required.

- Copyrights and Intellectual Property- The content developer shall warrant that there is no infringement of any patent or intellectual property rights caused by the development/conversion of e-contents which are subject matter of this project. NIMI will own the copyright in all deliverable materials created under the project. The content developer shall transfer Intellectual Property Rights (IPR) of all products developed/enhanced/ modified/ configured under this project to the NIMI.
- Plagiarism checks - shall be performed to ensure that the content developed is based on NIMI textbooks only and the digital content created by agency has not been copied from elsewhere.
- Do not use any brand image or logo or any material related to your firm or any other firm in the e-learning content other than NIMI.
- Firm should submit the final content in the SCROM, HD MP4, HTML 5, Compressed MP4 (should be sharable on social media) Formats.

Gearbox

Objectives: At the end of this lesson you shall be able to
- **state the need for a gearbox**
- **state the various resistances in vehicles motion**
- **calculate gear ratios**
- **state the different types of gearboxes**
- **describe the various components and their functions in a sliding mesh gearbox**
- **describe the various components and their functions in a constant mesh gearbox and its advantages**
- **state reasons for gear noise.**

Gearbox (Manual transmission)

A gearbox is used to get different torques and speeds which are required to overcome the following resistances.

- Road resistance
- Air resistance
- Gradient resistance
- Load on vehicle

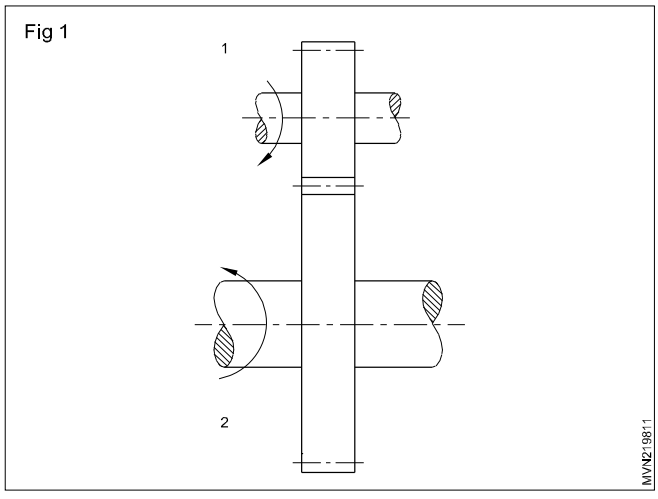
By engaging different gears, engine torque is increased while speed is decreased. In the top gear the r.p.m and torque of the engine and gearbox remain the same.

Simple gear train

When there is only one gear on each shaft it is known as Simple gear train. When the distance between turn shaft is small, it is used.

When a small gear (1) (Fig 1) drives the bigger gear (2) the r.p.m. of the bigger gear (2) is reduced in proportion of the gear tooth. For example: Gear (1) is having 10 teeth and gear (2) is having 20 teeth. Assuming gear (1) rotates at 50 r.p.m.

Fig 1



$$\text{Gear ratio (or) speed ratio} = \frac{\text{No.of teeth on driven}}{\text{No. of teeth on driver}}$$

$$\text{Gear ratio} = \frac{T_2}{T_1} = \frac{10}{20} = \frac{1}{2} = 1:2$$

Linear velocity 'V' remains the same for both the gears.

$$\text{So}, T_1 \times N_1 = T_2 \times N_2$$

$$N_2 = \frac{T_1 \times N_1}{T_2} = \frac{10 \times 50}{20} = 25$$

Here the r.p.m.of gear (2) is half of gear (1). So torque will be double.

It means in higher gear the torque is less and in lower gear the torque is more.

Different sets of gears are used in the gearbox to achieve different speeds and torques.

Compound gear train

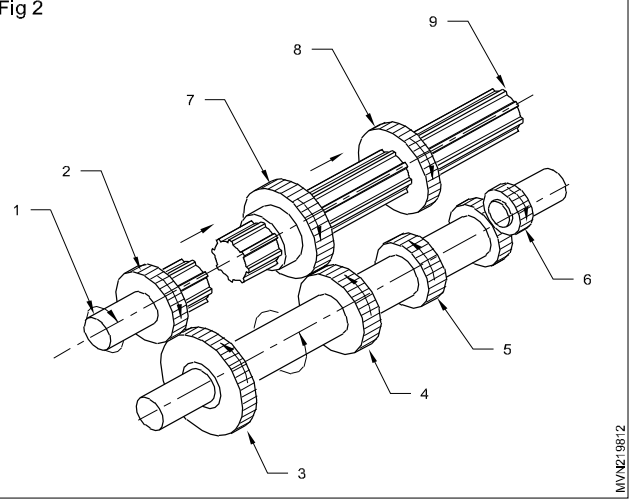
When there are more than one gear on a shaft it is called as compound gear train. When the distance between the driver and driven has to be bridged over by intermediate gears and at the same time high gear ratio or small gear ratio is required then the advantage of intermediate gears is intenstified by providing compound gears on intermediate shaft.

$$\text{Gear ratio} = \frac{\text{Product of the number of teeth on the driven}}{\text{Product of the number of teeth on the driver}}$$

Power train (Fig 2)

The drive shaft (1) along with the gear (2) is always rotating at the engine r.p.m. The shaft (1) drives the countershaft gear (3), (4) ,(5) & (6) which are fixed on the countershaft. The gears (7) & (8) on the main shaft (9) get power from the countershaft's respective gear, when engaged. To get the desired r.p.m or the torque the respective gear, on the main shaft (7) or (8) is engaged with the countershaft gears (7) and (8) are splined on the mainshaft and when these gears are engaged with the countershaft gears, power is transmitted to the main shaft (9). To get the reverse speed the idler gear (6) is used in between the main shaft and the countershaft gears.

Fig 2



Gear selection

The selection of gear depends upon the speed if the vehicle it to be driven. For example the speed and appropriate gear selection of a vehicle is given below:

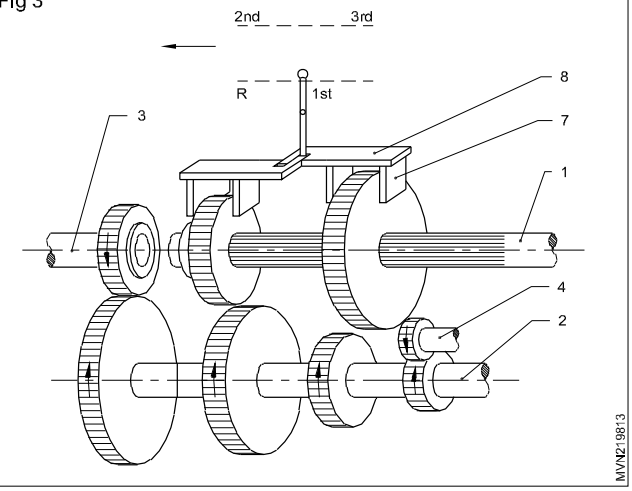
Gear selection	Speed in Km/h
Ist gear	15
IInd gear	30
IIIrd gear	45
IVth gear	65
Vth gear on top gear	80

Types of gear boxes

- Sliding mesh gearbox
- Constant mesh gearbox
- Synchromesh gearbox

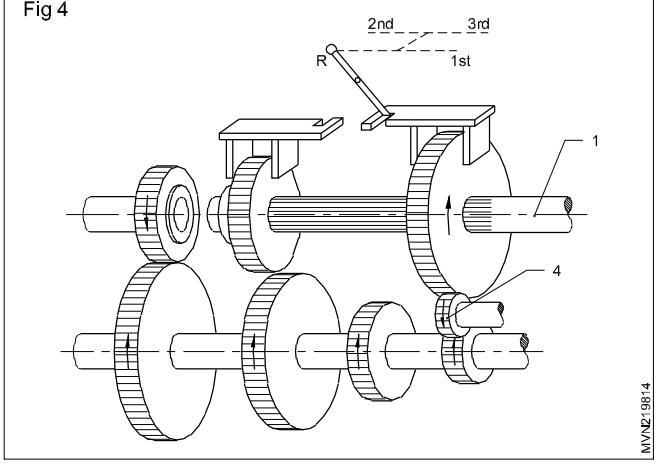
Sliding mesh gearbox (Figs 3 & 4)

Fig 3



In this gearbox, the gears are mounted directly on the main shaft (1). The gear is slided on the main shaft with the help of the shifter yoke mechanism (7) to engage with the countershaft (2) gear. The gears on the clutch shaft (3) and countershaft (2) are fixed. The idler gear is always in mesh with the countershaft's gear.

Fig 4



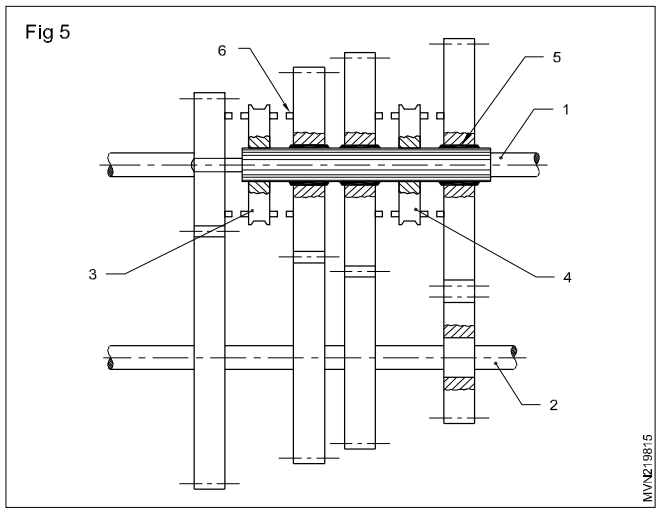
To achieve reverse speed, the mainshafts (1) gear is slided on the main shaft, to engage with the idler gear (4).

To slide the gear on the shaft the shifter forks (7) directly sit on the main shaft's (1) gear. The shifter forks are connected to the gear shift lever through the selector rods 8).

In this type of gearbox, spur gears are always used, because the gear is slided on the shaft to engage with the countershaft gear.

Constant mesh gearbox (Fig 5)

Fig 5



In this gearbox the gears of the mainshaft (1) are always in mesh with the corresponding gears of the countershaft (2). But power is not transmitted unless the dog clutch (3) or (4) engages with the particular gear on the main shaft (1). The main shaft is splined. In between the splined main shaft and gears, bushes (5) are provided.

The fixed dog clutch (6) is splined on the main shaft gear (1). Therefore the gear and the fixed dog clutch both rotate freely without transmitting power. The dog clutch can slide along and revolve with the main shaft. When the sliding dog clutch (3 or 4) is engaged with the respective gear's fixed dog clutch, power is transmitted from the gear to the main shaft through the sliding dog clutch (4) and fixed dog clutch (6).

In this type of gearbox, helical gears are used.

Advantages

The power transmission is smooth when helical gears are engaged because more than one tooth in contact at a time.

Easy to engage

Less wear of gears in comparison to the sliding mesh gearbox because gears are always in mesh and gear shifting is done through the sliding dog clutch.

Gearbox troubles

Gear noise

The following are the causes for noise in the gearbox.

- Wrong adjustment of gear shifting fork.
- Misalignment between gearbox and engine.
- Gearbox not lubricated.
- Excessive backlash between gears/worn out gears.
- Gearbox bearings damaged/worn out pitted
- Gear teeth broken / worn out

Bearings

When a component slides over or rotates around another part, the surfaces that contact each other are called bearing surfaces.

A bearing is a device placed between two bearing surfaces to reduce friction and wear.

Sliding bearings are used at following conditions:

- Low rotating speed
- Very large bearing surfaces
- Low use applications

Sliding bearings composed of a relatively soft bronze alloy, many are trade from steel with bearing surface bonded.

Rolling bearings/antifriction bearings such as roller bearing, ball bearings etc,. are used in high speed applications, high load with relatively small bearing surfaces, and high use.

In gear box gear rotating on c fixed shaft can have more than one bearing surface, it is supported and held in place by the shaft in a radial direction with the help of the bearings.

Bushes

Bushes are cylindrically shaped and held in place by press fit. Since bushes are typically made of a soft metal, they are act like a bearing and support many of the rotating parts. It takes the radial load.

Thrust washers

It s fitted with roller bearings. Thrust bearings/washer's are used limit the end play and also reduce the friction between two rotating parts. Roller bearings are used in combination with flat thrust washers to control end play of a shaft or the gap between a gear and its drum.

Static

A seal used between two parts that do not move in relationship to each other, such as the pan and oil pump-to-case gaskets.

Dynamic

A seal used between two parts that do move in relationship to each other. This movement is either a rotating or reciprocating (up and down) motion. The seal of a clutch piston an example of this of seal.

Positive

A seal that prevents all fluid leakage between two parts.

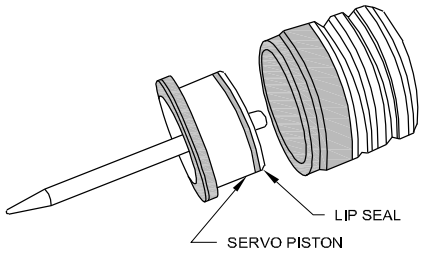
Non positive

A seal that allows a controlled amount of fluid leakage. This leakage is typically used to lubricate a moving part.

Three major types of rubber seals are used in manual automatic transmission. They are 'O' ring, Lip seal and the square cut seal. Normally an 'O' ring is installed in a grooves cut into the inside diameter of one of the parts to be sealed. 'O' ring is compressed between the inner part and the groove 'O' ring, seal forms a tight seal between the two parts.

Lip seals (Fig 6) are used to seal parts that have axial or rotational movement. Lip seals are used around input and output shafts to keep fluid in the housing and dirt out. Lip seals are also commonly used as shaft seals.

Fig 6



Square cut seals

It is similar to an 'O' ring, however, a square-cut seal can withstand more axial movement than an 'O' ring can. Square-cut seals have a rectangular or square cross section. They are designed this way prevent the seal from rolling in its groove, when there are large amounts of axial movement.

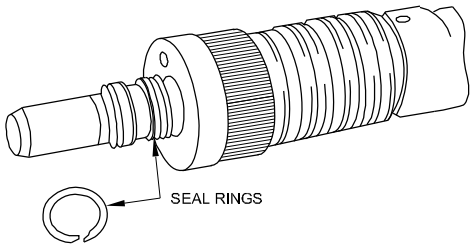
Metal sealing ring (Fig 7)

The metal sealing rings are used at the places in which some leakage is acceptable metal sealing rings are used in transmission at pressurized. Ring seals are made of cast iron, nylon or teflon.

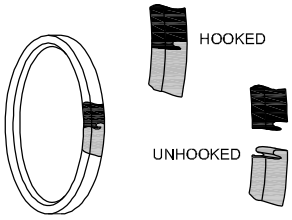
Teflon seals

Some transmission use teflon seals instead of metal seals. Teflon provides for a softer sealing surface, which results in less wear on the surface that it rides on and therefore a longer-lasting seal. Teflon seals are similar in appearance to metal seals except for the hook-end type. The ends of locking end teflon seals are cut at an angle (Fig 8).

Fig 7



METAL SEALING RINGS



HOOK-END SEALING RINGS

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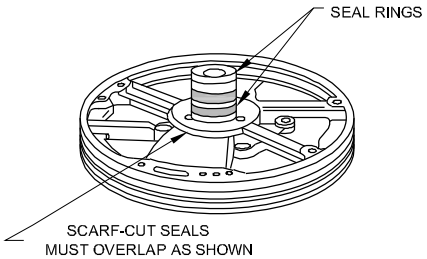
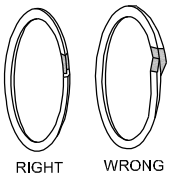
Fig 8





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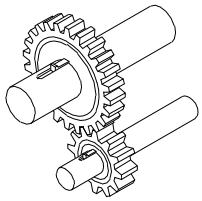
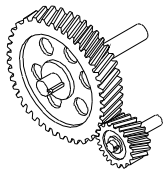
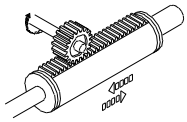
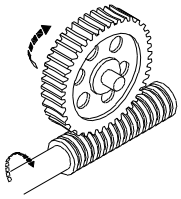
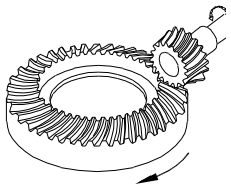
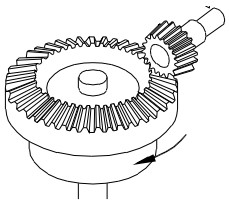
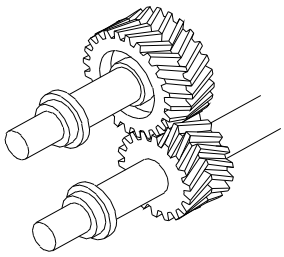
TYPES OF GEARS

Spur gears	Helical gears	Rack & pinion	Worm gears
			
Teeth are straight and parallel to the gear axis.	Teeth are at an angle to the gear axis.	Teeth are parallel to the axis of the gears.	Teeth are at an angle with the axis and are curved.
Only one tooth in contactact at a time	More than one tooth in contact at the same time	Only one tooth in contact.	More than one tooth in contact.
No axial thrust is produced while transmitting torque. Hence it is often used for reverse gear in transmission	Axial thrust is produced while transmitting torque.	No axial thrust is produced while transmitting torque.	Axial thrust is produced while transmitting torque.
It transmits torque for parallel and non-coplanar shaft	It transmits torque for parallel and non-coplanar shaft	It converts rotary motion into linear motion and vice versa.	It transmits torque at right angle for parallel and non-coplanar shaft
Drawback: Clicking noise during teeth contact	Drawback: Due to axial thrust gear will move front and back		

Spiral bevel gears	Spur bevel gears	Herring bone gears
		
Teeth are curved.	Teeth are straight.	Teeth are straight at an angle and opposite.
More than one tooth in contact.	Only one tooth in contact.	More than one tooth in contact.
Produces axial thrust.	Produces axial thrust.	Although teeth are inclined, the shaft does not produce axial thrust. It neutralises the axial thrust.
Used to transmit torque at 90°. axis	Used to transmit torque at 90°.	Used to transmit torque for parallel and coplanar axis.

Synchromesh gearbox

Objectives: At the end of this lesson you shall be able to
- **explain the need of synchromesh action in a gearbox**
- **list out the different types of synchromesh gearboxes**
- **explain each type of synchromesh gearbox**
- **explain the function of a synchromesh unit**
- **explain power flow in different gear positions**
- **explain the advantages of a synchromesh gearbox over-sliding mesh and constant mesh gearboxes.**

Synchromesh are used for easy gear shifting when a vehicle is in motion.

With synchromeshing action, gears can be changed without using double declutching. An unskilled driver can also change gears with less danger of gear clashing as in the case of in-sliding mesh and constant mesh gearboxes. .

Synchronising action (Figs 1,2 & 3)

Fig 1

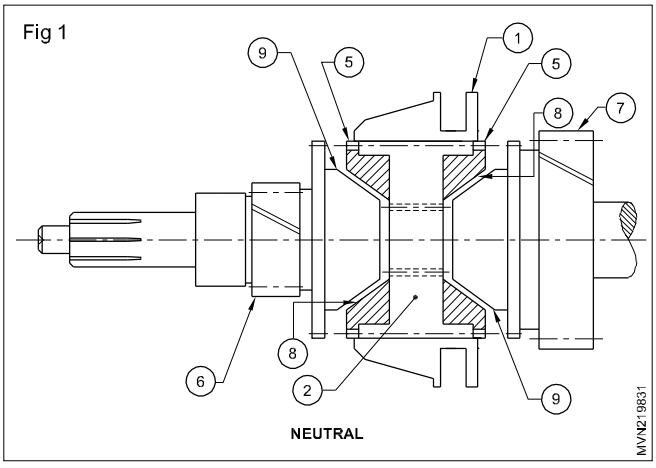
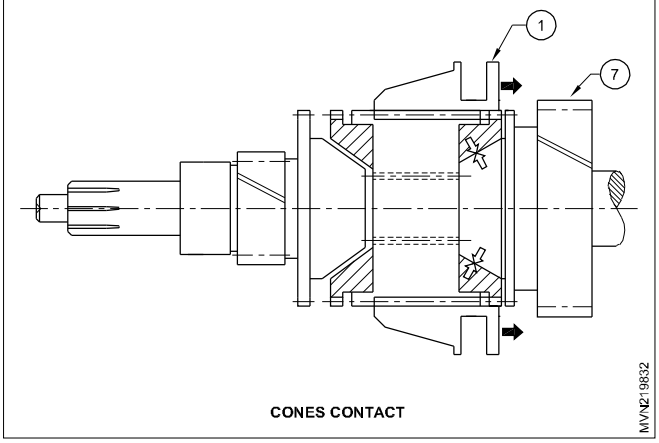


Fig 2

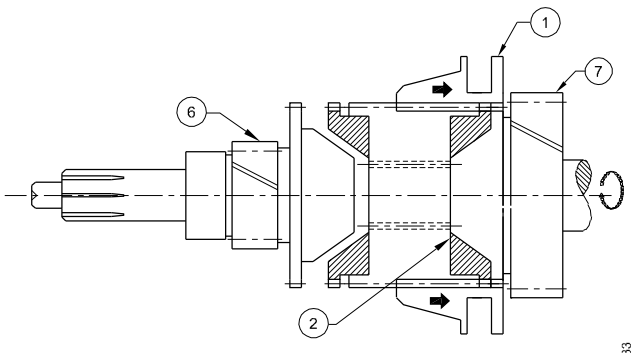


A synchroniser unit has a synchroniser sleeve (1), hub (2), a set of blocking rings (5), conical cup (8) provided on the blocking ring. Correspondingly a cone (9) shape is provided on gears (6) and (7) to suit the matching of the cup (8) and cone (9). Gears (6) and (7) rotate in mesh with the countershaft gear whereas the hub (1) rotates at the main shaft's speed.

Whenever any particular gear is to be engaged, the sleeve (1) is pushed towards the gear, and it further pushes up (8). The first cup (8) makes contact with the

cone (9) of the gear (7) and due to friction between the cone and the cup's blocking ring (5) and gear (7) start rotating at the same speed. Further movement of the sleeve (1) engages the dog teeth of the sleeve (1) with the dog teeth of the blocking ring (5) and gear (7). As at this stage the blocking ring and gear are rotating at the same speed. This engagement is carried out smoothly without double declutching and without causing any clashing noise.

Fig 3



POSITIVE DRIVE

MVN219833

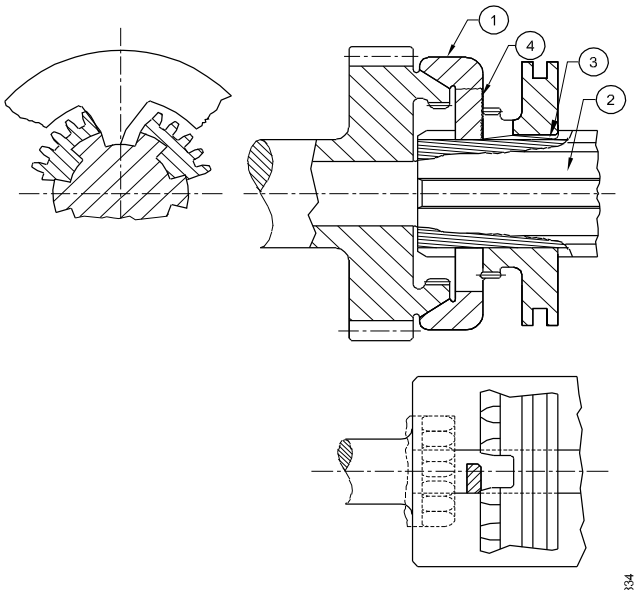
Types of synchromesh gearboxes

The various types of synchromesh gearboxes are given below:

- baulk type
- baulk ring type
- multi and double cone type
- porche type

Baulk type (Fig 4)

Fig 4



BAULK TYPE SYNCROMESH DEVICE

MVN219834

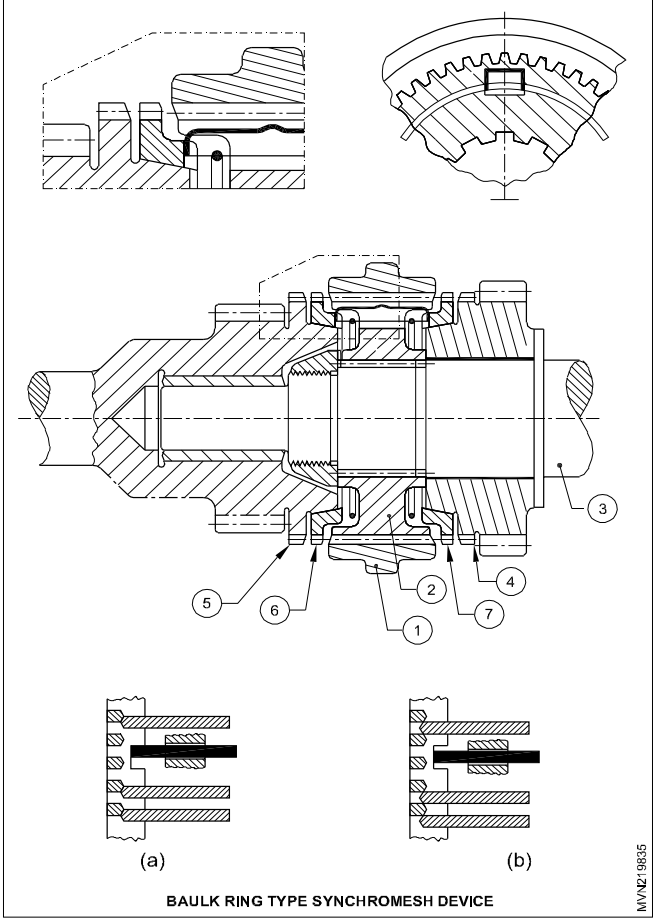
In this type the cone (1) and the main shaft (2) rotate at the same speed.

The cones will be pressed together and the friction between them will tend to bring about synchronising.

It needs minimum pressure to press the cones together. Once the gear is engaged, the springs (3) will press against the fingers (4) and hold the gear in position.

Baulk ring synchromesh (Fig 5)

Fig 5



BAULK RING TYPE SYNCHROMESH DEVICE

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This type of synchroniser unit is mostly used to engage the IV gear from III and vice versa.

In this dog clutch sleeve (1) is free to slide on the splines on the hub. The hub (2) is fixed to the main shaft; when the clutch sleeve is moved to the right its internal splines engage the dog teeth to the 3rd gear (4), and when it is moved to the left its splines engage with the dog teeth of the 4th gear (5). The synchronising action is provided by the baulk rings (6 & 7) which are having internal cones to engage with the external cones formed on gears.

Multi and double cone synchronisers

This type is mostly used for heavy commercial vehicles.

This type is provided with three slipping surfaces in the cone assembly.

In this type the torque will be three times more than the other types.

Porsche synchroniser

In this type the gear on the end of the clutch shaft drives the lay shaft.

It consists of a three-armed spider.

This synchroniser is used to change the top gear with a positive drive between the top gear and the main shaft.

It is designed to obtain uniform pressure between the ring and the sleeve.

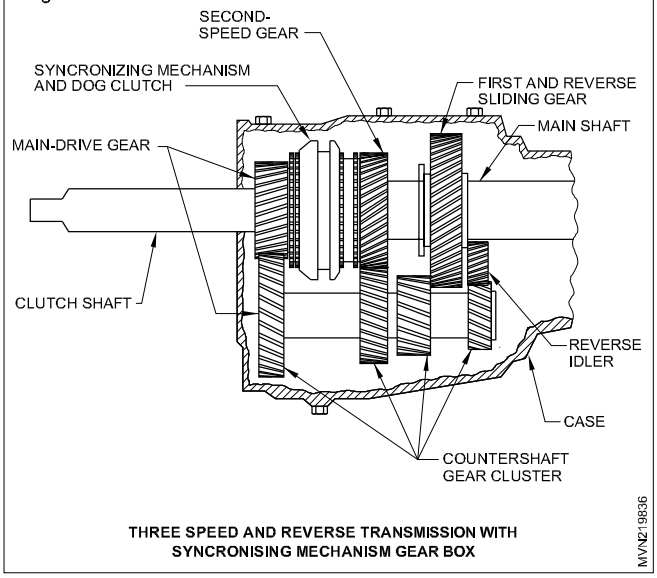
The above two synchronisers are not widely used in Indian vehicle. hence figures are not given.

The synchromesh gearbox and power flow in different gears.

Introduction

A 3-speed all helical gear, synchromesh gearbox (transmission) of a passanger car is shown in Fig 6.

Fig 6



THREE SPEED AND REVERSE TRANSMISSION WITH SYNCRONISING MECHANISM GEAR BOX

It has 3 forward speed and one reverse speed for selection. This is closed as manually operated selective type because te driver can select the required gear ratio by shifting the gear by the operation of the gear shift lever.

Construction

The gearbox shown in Fig 6 here consists of the following main parts.

Case and extension of housing

Rotating parts including bearings

Shift mechanism

Details

The case houses all parts of the gearbox and serves as a container for the gear oil.

The rotating parts consist of te main and lay shafts, its bearings, gears, dog clutches and synchroniser mechanism.

The case cover carries a selector and shifter mechanism and seals the gearbox housing against water and dirt.

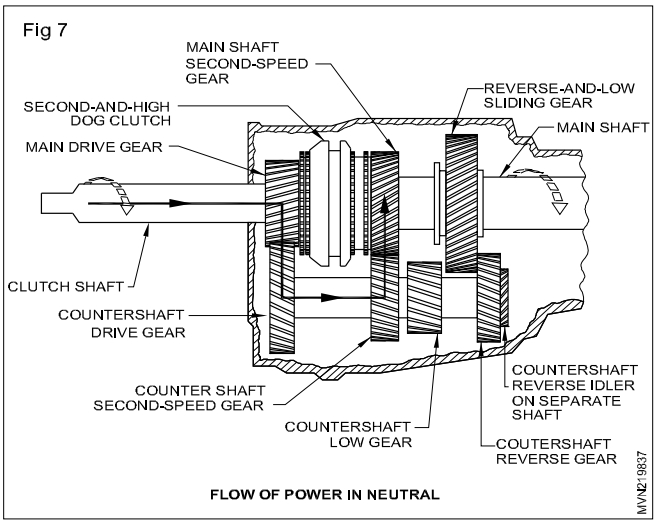
Gear ratios	Jeep vehicle
Ist gear	2.798:1
IInd gear	1.151:1
Top or IIIrd gear	1:1
Reverse gear	3.798:1

Power flow in different gear positions is shown by figures below and also briefly discussed.

Power flow in Neutral

Neutral position (Fig 7)

Fig 7



FLOW OF POWER IN NEUTRAL

In the neutral position there is no flow of power from engine-clutch primary shaft transmitted to the gearbox main shaft. This condition helps to start the engine and run it without movement of the vehicle.

Secondly, the main shaft and lay shaft second speed gears are in constant mesh but the second speed and high speed dog clutch is not engaged. Also the main shaft second speed gear is not splined or keyed to the main shaft but it simply rotates on it without transferring any power.

The black line with arrow shows the power flow from the clutch shaft to the countershaft through the main drive gear and countershaft gears which are in constant mesh.

All gears are revolving but no power is being transmitted.

Power flow in first or low gear

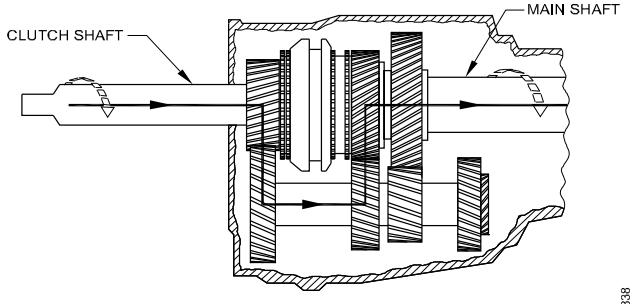
First or low gear (Fig 8)

The power flow in first or low gear is shown in the figure.

By shifting the reverse and low sliding gear towards the left and making it mesh with countershaft (Layshaft low gear, First gear) position is obtained. The ratio is 2.798:1. The clutch primary shaft drives the countershaft through the main drive gear and countershaft drive gear.

The flow of power (shown in black line arrow) goes from the countershaft to the main shaft, through countershaft low gear to the reverse and slow sliding gear (I gear) which is splined to the gearbox main shaft and then to the U-joints and to the rear wheels.

Fig 8



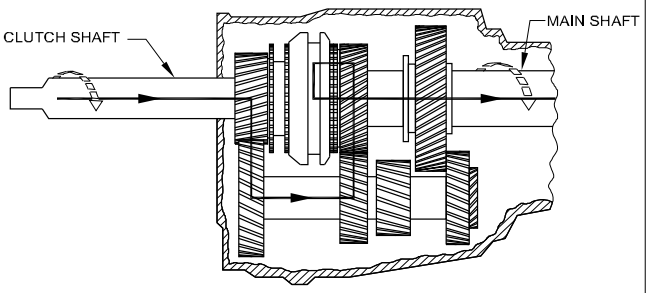
FLOW OF POWER IN LOW GEAR

Speed of main shaft = 1/2.798 of clutch shaft speed.

All forward shifting is accomplished by action of the mechanism synchroniser.

Second gear position (Fig 9)

Fig 9



FLOW OF POWER IN SECOND GEAR

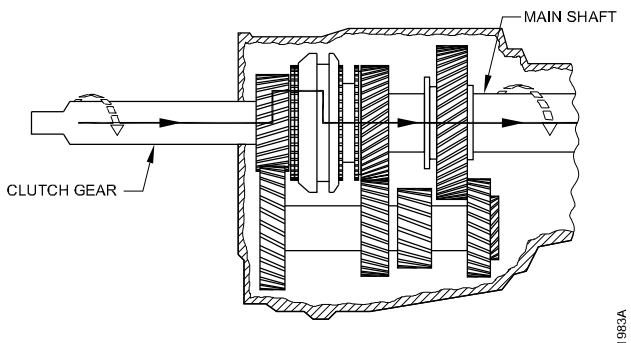
The first engagement is released out by shifting the first and reverse sliding gear out of mesh and bringing the system to neutral position.

The synchroniser sleeve is then moved to the right so that its teeth are meshed with the teeth on the hub of the second gear after synchronisation. The synchroniser hub is internally splined to the main shaft. Hence the power flows through clutch shaft main drive gear to the counter shaft second speed gear which turns the main shaft.

Speed of main shaft = 1/1.151 of clutch shaft speed.

Top gear or high gear position (Fig 10)

Fig 10



FLOW OF POWER IN HIGH GEAR (TOP GEAR)

Power flow in the top gear is shown in the figure. The synchroniser sleeve is moved to the left so that its teeth could mesh with the teeth on the hub of the main drive gear after the second speed gear is released out of engagement. Now a direct drive engagement takes place locking the main shaft to the clutch shaft.

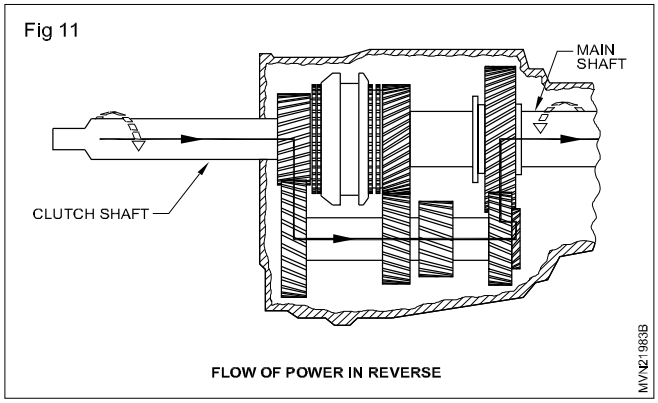
Speed of main shaft = speed of clutch = 1:1 shaft

No power is transmitted through the other revolving gears in the system.

The power flow the line (arrow) shows the direct drive through the synchroniser mechanism to the gearbox main shaft.

Reverse gear position (Fig 11)

Fig 11



FLOW OF POWER IN REVERSE

In this gear, the synchroniser mechanism stands in neutral position. The clutch shaft and the main shaft are seperated from the drive.

By operating the gear shift lever the reverse and low sliding gear is moved to the right and is engaged with the reverse idler gear. This engagement causes the change of direction of rotation of the reverse gear which in turn transfers the drive to the main shaft. Now the main shaft rotates in the reverse direction. The drive is then transmitted to the road wheels at the rear through U-vehicle moves in the reverse direction.

The power flow is from the clutch shaft main gear, countershaft gears, the reverse idler and then to reverse and low sliding gear and then to te main shaft.

Speed of main shaft = 1/3.798 of clutch shaft.

Advantages of synchromesh gearbox over sliding and constant mesh gearboxes.

It requires less force to change the gears.

In sliding mesh gear boxes, the gear wheels themselves move on the shaft to mesh with each other which is eliminated in the synchromesh gearboxes, thereby increasing the life of the gears.

The constant mesh and sliding mesh gearbox requires double declutching while changing the gears which is not needs in a synchromesh gear boxes.

An unskilled driver can operate the synchromesh gear boxes as compared to constant mesh and sliding mesh gearboxes since double declutching is not required for this.

Synchromesh gearbox troubles

Objective: At the end of this lesson you shall be able to
- **list out the various troubles and their causes in a synchromesh gearbox.**

Common troubles and remedies in a synchromesh gearbox

Trouble	Causes	Remedies
Hard gear shifting	Synchronising unit damaged or springs improperly installed after service	Replace the unit or re-install springs correctly
Gear locked in one gear	Synchronising unit stuck	Free the sticking units. Replace the damaged parts.
Gear slip	Synchroniser worn out or defective	Repair/replace
Noise from gearbox in neutral position.	Bearings worn out or dry	Lubricate/replace. Fill gear oil to correct level.
	Insufficient lubricant in the gear box. Gear box misaligned with engine.	Check and realign.
Transmission noisy in gear	Clutch friction disc defective. Synchroniser worn out or damaged. Gears worn out	Replace/set right. Replace the Replace the worn out or damaged or damaged part
Gear clash during shifting	Synchroniser defective. Clutch free play too much. Gear shifting linkage out of adjustment.	Repair or replace. Adjust clutch pedal free play. Readjust again.

Overhaul the synchromesh gear box

Objectives: At the end of this exercise you shall be able to
- **dismantle the gear box**
- **clean the gears using suitable solvent**
- **check the gearbox and its parts**
- **assemble the gearbox.**

Requirements

Tools / Instruments

- Trainee tool kit - 1 Set
- Spanners socket pieces with box - 1 Set
- outside micrometer - 1 No.
- Torque wrench - 1 No.
- Feeler gauge 20 blades (metric) - 1 No.
- Oil can 0.5/ 0.25 litter capacity - 1 No.
- Bearing puller - 1 No.
- Electric pedestal grinder with two 18cm. Wheel - 1 No.
- Taps and Dies - 1 Set
- Cleaning tray - Aluminum 45 X 30 cm - 1 No.

Equipment / Machineries

- Vehicle gear box - 1 No.

Materials

- Gear oil SAE.90 - as reqd.
- Kerosene - as reqd.
- Banian cloth - as reqd.
- Grease - as reqd.

PROCEDURE

TASK 1: **Dismantle the gear box**

1 Remove the drain plug (1) and drain the oil (Fig 1)

2 Remove the filler plug (2)

3 Remove the shift lever housing pin (4)

4 Remove the shift lever from the housing.

5 Remove the shift housing bolts (5)

6 Remove the gear shift housing assembly (6) along with the gasket (7) and shifting fork (8) from the gearbox housing (3).

7 Remove the screws (9) and washer of the pinion shaft's (33) bearing retainer (10) with the felt (11).

8 Remove the retainer and gasket (12)

9 Remove the lock plate (13) through the slot cut in the rear end of the countershaft(14) and the reverse idler gear shaft (15)

10 Drive out the countershaft (14) by using the brass drift.

11 Allow the countershaft gear set (16) to drop to the bottom of the gearbox housing.

12 Remove the cotter pin (17)

13 Remove the main shaft nut (18) and washer (19).

14 Remove the main shaft rear bearing (20)

15 Remove the rear bearing spacer (21)

16 Remove the main shaft (22) along with the gear from the case through the rear bearing spacer's (21) opening.

17 Remove the sliding gear (23) (1st and reverse gear) from the main shaft (22)

18 Remove the blocking ring (24)

19 Remove the snap ring (25)

20 Remove the synchronizer clutch sleeve (26). While removing the clutch sleeve take care of the synchronizer plates (27) and remove the synchronizer plates (27) and spring (28)

21 Remove the clutch hub (29)

22 Remove the 2nd blocking ring (30)

23 Remove the 2nd speed gear (31)

24 Remove the bearing lock snap ring (32)

25 Drive out the pinion shaft (33) along with the bearing (34) and washer (35).

26 Remove the pilot needle bearing (36)

27 Remove the countershaft gear set (16)

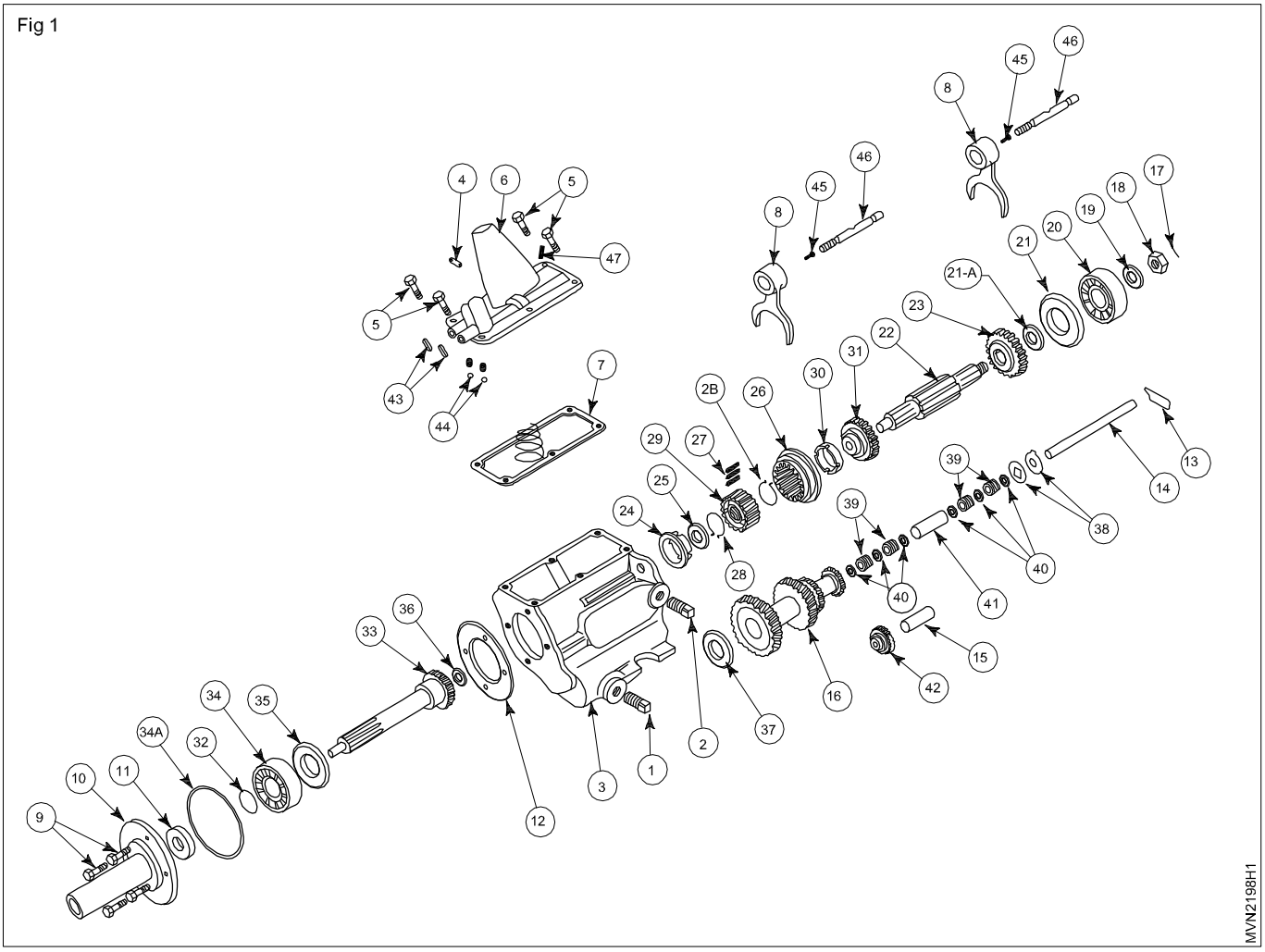
28 Remove the front and rear thrust washers (37,38)

29 Remove the roller needle bearings (39) from the counter shaft gear set along with the washers (40) and spacer (41).

30 Remove the reverse idler gear shaft (15) by using a brass drift.

31 Remove the reverse idler gear (42)

Fig 1



32 Dismantle the gear shift housing assembly by removing the interlock plunger (47) , the rail caps, (43) poppet balls and springs (44) shifting fork lock pins (45) shifting rails (46) and shifting forks (8).

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TASK 2: **Clean the gears using suitable solvent**

1 Wash the gear box housing (3) thoroughly inside and outside with a cleaning solvent.

2 Clean all the components with a cleaning solvent.

3 Inspect the synchronizer rings and cones for wear, crack and overheat.

4 Inspect the synchronizer clutch sleeve (26) and dog teeth for damage.

5 Inspect the hub's (29) splines for damage and free movement on the main shaft (22)

6 Inspect the synchronizer shifting plates (27) for damage and proper seating.

7 Inspect the blocking rings (24 & 30) for wear, crack and overheat.

8 Inspect hub snap ring (25) for proper tension and seating.

9 Inspect the gear box housing (3) for crack.

10 Inspect the bearings for crack, damage and overheat.

11 Inspect all the gears for wear, crack, damage and overheat.

12 Check the gears for free movement on the main shaft (22)

13 Inspect the bushes for wear and damage

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TASK 3: **Check gearbox parts**

1 Inspect the shaft bores in the gear box housing for wear and true.

2 Inspect the main shaft's (22) spline for damage.

3 Inspect the countershaft bore with case for damage.

4 Inspect the main drive shaft (33) for damage, wear and overheat.

5 Inspect the counter-gear set (16) for damage and wear.

6 Inspect the countershaft (14) for damage and overheat.

7 Inspect the reverse idler gear shaft (15) for damage.

8 Inspect the bush, roller bearings (39) for crack, wear and overheat.

9 Inspect the bearing seating areas in the gear box housing.

10 Inspect the rails (46) of the shifting mechanism for wear and bend.

11 Inspect the forks (8) for damage, wear and bend.

12 Check all gear teeth for pitting overheating marks wear and breakages and replace where necessary.

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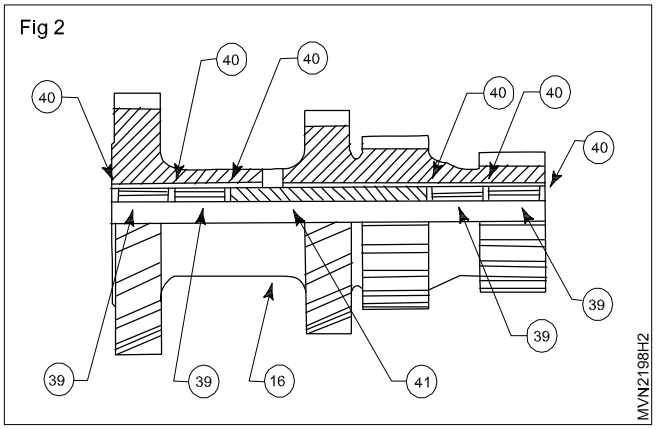
TASK 4: **Assemble the gearbox**

1 Assemble the reverse idler gear (42) and shaft (15) into the case (3). When fixing, ensure that the chamfered side of the idler gear faces towards the sliding gear.

Fig 2



2 Align the slot on the reverse gear shaft (15) for proper locking.

Assembling the countershaft gear set

1 Insert the spacer (41) into the countershaft gear's (16) hub. (Fig 2)

2 Place the washers (40) at each end of the spacer (41) and push needle bearings (39) at each end. Again add washer (40) at both the ends and push the needle bearings (39). Finally place one more washer (40) at both ends and complete the assembly.

3 Place the countershaft gear set (16) in the bottom of the gear box housing (3). Ensure that the larger gear faces towards the pinion shaft in the gear housing.

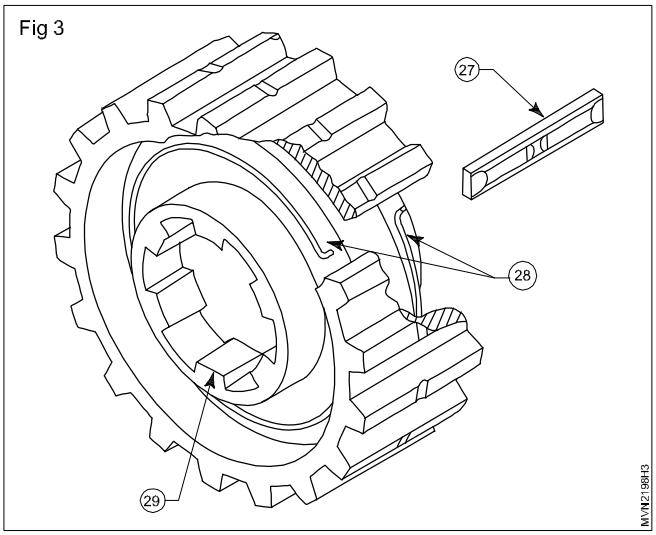
4 Apply grease on the front and rear thrust washers (37 & 38) and place them at their respective positions in the gearbox housing.

Assembling the synchromesh unit

1 Install two synchronizer springs (28) in the hub (29) with the spring tension opposed. (Fig.3)

2 Place the ends of the spring in the slots of hub.

Fig 3



3 Install the three synchronizer shifting plates (27) in the three slots in the clutch hub (29) with the smooth side of the plate facing outward.

4 Hold the plates in position.

5 Slip the clutch sleeve (26) over the clutch hub.

6 Install the 2nd speed gear (31) on the main shaft (22). Ensure that its dog teeth face towards the front of the gearbox housing.

7 Place the blocking ring (30) on the second speed gear towards the front of the gearbox housing.

8 Install the clutch hub (29) with the clutch sleeve (26) on the main shaft front end without disturbing the synchronizer plate.

9 Lock the hub with the main shaft by inserting the clutch hub snap ring (25)

10 Pass the front end of the main shaft (22) in the case (3) through the rear end bearing opening and assemble the low and reverse sliding gear (23) on the main shaft. Ensure that the shifting groove of gear faces towards the front of the gearbox housing.

11 Place the bearing spacer (21A) on the main shaft rear side.

12 Fix the rear bearing spacer (21)

13 Assemble the rear end bearing (20)

14 Place the main shaft washer (19)

15 Tighten the main shaft castle nut (18) at the recommended torque.

16 Lock the castle nut (18) by the cotter pin (17)

17 Apply grease and place the pinion shaft pilot bearing (36) in the pinion shaft spigot.

18 Install the bearing washer (35) bearing (34) and the bearing snap ring (34A) on the pinion shaft.

19 Install the pinion shaft (33) with bearing on the housing and fix the pinion shaft snap ring (32).

20 Place the oil seal (11) in the bearing retainer (10).

21 Fix the bearing retainer (10) with a gasket (12) to the case (3).

22 Lift the counter-gear set (16).

23 Align the countershaft front thrust washer (37) and rear thrust washers (38) with the bore of the countershaft gear set (16).

24 Align the counter - gear set bore and gear housing's front and rear bores.

25 Insert the countershaft(14) into the counter-gear set (16)

26 Tap the countershaft (14) to enter into the front side of the gearbox housing. Ensure the position of the three thrust washers. Please check the gear end plays as per manufacturer's specifications. (Sample data is given Table 1)

27 Align the countershaft and idler gear shaft slots.

28 Fix the lock plate (13)

29 Fix the drain plug (1).

30 Fill up gear oil to the specific level and fix the filler plug (2)

31 Place the gears in neutral position.

32 Invert the gearbox top cover housing (6) and clamp it in a vice.

33 Install poppet balls and springs (44) in the respective holes provided on the housing.

34 Insert two shift rails (rods) (46) in the respective holes on the housing by using a wooden mallet and also insert the shifter forks on the rails simultaneously.

35 Lock the forks (8) on rails by lock-pins (45)

36 Push the shift rails further inside their respective holes so that the balls locate themselves on the grooves in the shift rails.

37 Put the rail caps (43) at the end of the shift rails and press them firmly.

38 Assemble the interlock plunger (47) on the shifter rail assembly.

39 Insert the gear shift lever in the centre hole on the housing and lock it with the lock-pin and check its movement.

40 Place the gasket (7) on the transmission case and align the hold.

41 Position the shifting mechanism in neutral position.

42 Install the shifting mechanism with forks aligning on to the gear wheel grooves.

43 Engage the different gears with the help of the shifting lever and its mechanism and check their performance.

Figure 4 shows a synchroniser set for a gear. If the synchroniser ring is worn out replace the same with a new one.

Figure 5 shows 5-speed synchromesh gear box.

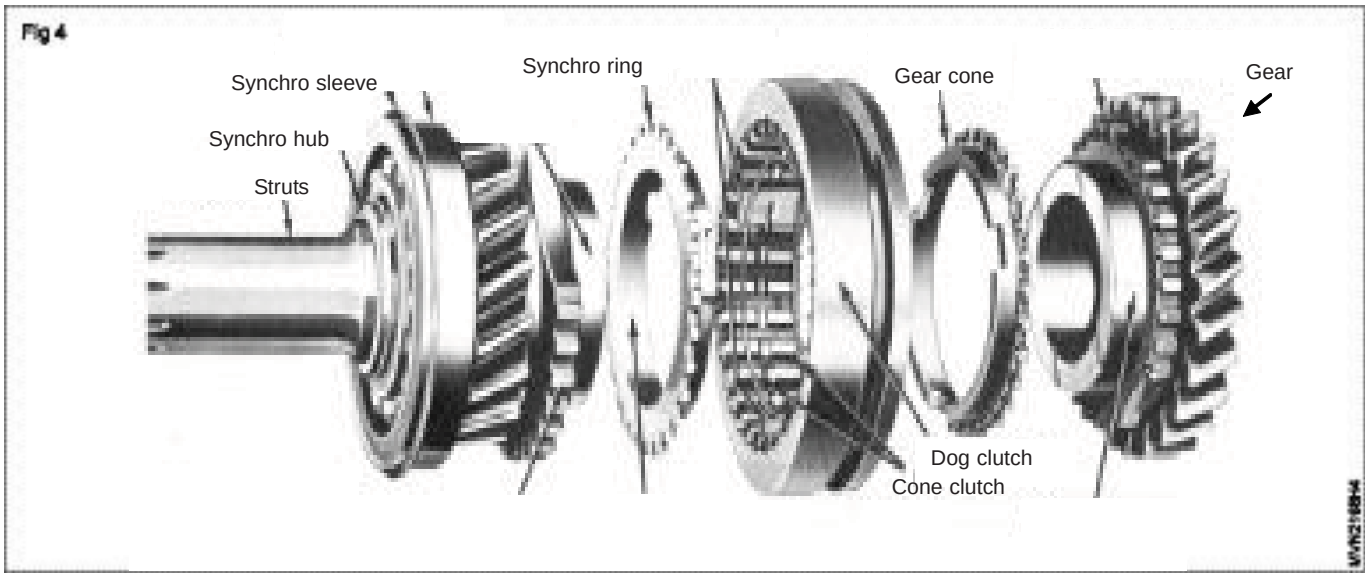
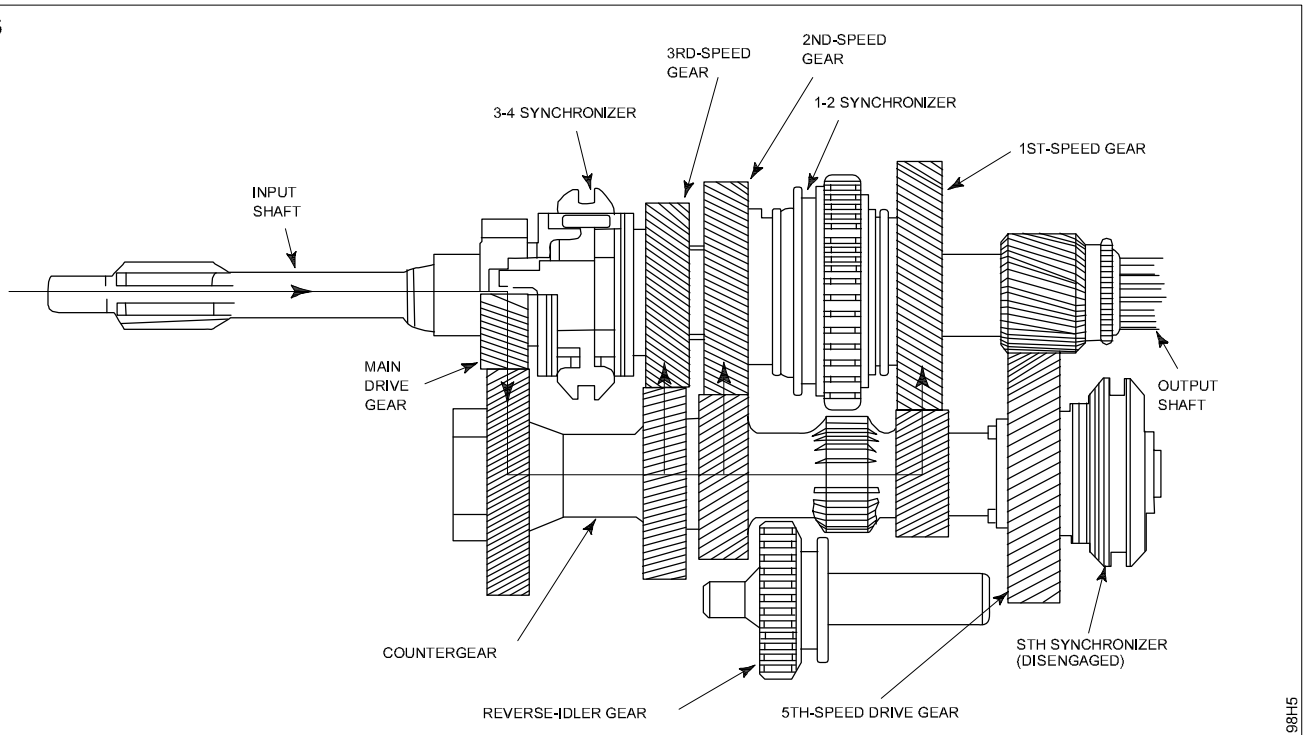


Fig 5



FIVE SPEED MANUAL TRANSMISSION

Table 1

Data

Descriptions	Tolerance limits
Backlash between main shaft and countershaft gears	- 0.10 to 0.17mm
Overall end float of fixed elements (main shaft)	- 0.152/0.813 mm
End play of mainshaft gears	
1st gear	- 0.838/0.99mm
2nd gear	- 0.711/0.864mm
3rd gear	- 0.330/0.483mm
4th gear	- 0.330/0.483mm

44 Fix the gear box with vehicle and test the performance of gear box during vehicle running on the road.

Causes and remedies

Cause	Remedy
Low oil level	Fill the oil in correct level
Bearing worn out	Replace bearing
Gear teeth worn out	Replace gear
Excessive back lash	Adjust back lash