## प्रथमोऽध्यायः

## ఒందెనెఁ అధ్యాయి

## దాఙ్మయుదెల్ల

## 

## ష్య్త్తాని:-











 సగుబుదిల్ల. దంณియు ఇదస్ను తన్న చలత్యాదఠశఁదల్లి-

वाचामेव प्रसादेन लोकयात्रा प्रवर्तते ।
इदमन्धतमः कृत्स्नं जायेत भुवनत्र्यम् ।
यदि शब्दात्वयं ज्योतिरासंसारं न दीप्यते ॥จ
ితిిసరుత్తానా.


 అరిలాగుత్తడే.




 उ०స్త్ర్ర్రు


## Ш్యాచరణ யబదద అఖణ:-









## ఎ్యాచరణ జుదద నిఐణひసగఆఆు:-

याक्रियन्ते व्युत्पाद्यन्ते असाधुभ्यः इब्देभ्यः विविच्यबोध्यन्ते यत्र तत् व्याकरणम् ॥ी व्याक्रियन्ते व्युत्पाद्यन्ते प्रकृति प्रत्ययविभागेन इब्दाः इति व्याकरणम् ।
व्याक्रियते अनेनेति व्याकरणम् (करण प्रधानम्)
व्याकरोति भाषामिति व्याकरणम् (कर्तृ प्रधाम्)
व्याकृतिः व्याकरणम् (भाव प्रधानम्) । ${ }^{2}$










 తృత్తిరలయ స్సం $ం త ే య ల ్ ల ి ద ి . ~$

वाग्वैपराच्य व्याकृतावदत्। ते देवा इन्द्रमबुवन् इमां नो वायं व्याकुर्विति तामिन्द्रो मध्यतोवक्रम्य व्याकरोत् तस्मादियं व्याकुतावाक् ${ }^{\Omega}$









## ఎెలదాంగేాలగి ప్యాచరణ:-













सर्वेषां व्यवहारणां मूलं राब्दार्थ निर्णयः।
सच व्याकरणादेव मुनिभिस्तेन तत् कृतम् ॥















साक्षात्कृत धर्माण ऋषयो बभूवुः।
ते अवरेभ्योऽसाक्षात्कृत धर्मभ्य उपदेशोन मन्त्रान् संप्रादुः ॥
उपदेशाय ग्लायंतो अवरे बिल्मग्रहणायेमं ग्रंथं
समाम्नासिषुः वेदं च वेदङ्गानि च ॥ ${ }^{\Omega}$


 బెలశిండు మిధి ணేంరీతుు.

 ఋొందిన రెల్లలశ తితిసెత్తడి.

छन्दः पादौ तु वेदस्य हस्तौ कल्पोऽथ उच्यते ।
ज्योतिषामयनं चक्षुर्निरुक्तं श्रोत्रमुच्यते ॥
शिक्षा घ्राणं तु वेदस्य मुखं व्याकरणं स्मृतम्।
तस्मात् सांगमधीत्यैव ब्रह्मलोके महीयते ॥?
ఈ ని⿷్టినల్లి
वागेवार्थं पइयति वाग्रवीति
वागेवार्थं निहितं सन्तनोति ।

वाच्येव विश्वं बहुरूपं निबद्धं
तदेतदेकंप्रविभज्योपभुङ्के ॥
ఎంబిల ఎజేనవు ணొంరీకిది.
'ఎాశో తత్త్యబెల బద్ధియాగి తన్నిందలిల ఎిబతణగింండ జగత్తగ్ను










1. वागेव विश्वा भुवनानि जज़े $\rho^{\rho}$

2. नामैवेदं रूपत्वेन विवृते ।

3. विभज्य बहुधात्मानं स च्छन्दस्यः प्रजापतिः।

छन्दोमयीभिर्मात्राभिः बहुधैव विवेश तं ॥ ${ }^{2}$




वेदशब्देभ्य एवादौ पृथक् संस्थाश्च निर्ममे॥









## 

 ఎిఱరిసతత్తనగ.
"बबहहस्पतिरिन्द्राय दिव्यं सहस्वर्षं प्रतिपादोक्तानां शब्दानां पारायणं प्रोवाच इति ।"



प्रथमं प्रोच्यते ब्राह्मं द्वितीयमैन्द्रमुच्यते ।
याम्यं प्रोक्तं तथा रौद्रं वायव्यं वारुणं तथा।
सावित्रज्च तथा प्रोक्तमष्टमं वैष्णवं तथा ॥
 ळొతిదసు. అదన్ను బృळస్టతియ ఇంద్రనిగి నంతర ఇండ్రను అన్యరగగ హబ్దాను లాసనపన్ను గురుజరంజెరేయాగి ఒబ్బరండ ఒబ్బరగగ గలగుత్తర బందితు

 శేళగినంతే మేఆఆలాగిడా.

## తృత్తరలయి శ్ంంతయయల్లి:-

"वाग्वे वराच्यव्याकृतावदता ते देवा इन्द्रमब्रूवन् इमां नो वाचं व्याकुर्तिति तमिन्द्रो मध्यतोऽवक्रम्य व्याकरोत् इति ए"



"महेश्वरः खलु वेदात् षडङ्गानि उद्धृत्य व्याकरोदिति ।"




समुद्रवद् व्याकरणं महेश्वरे तदर्धकुम्भोद्दरण बृहस्पतौ। तद्धागभागान्च शतं पुरन्दरे कुराग्रविन्दूत्पतितं हि पाणिनौ ॥




नृत्तावसाने नटराजराजो
ननाद ढक्कां नवपन्चवारम् ।
उद्धर्तुकामः सनकादिसिद्धान
एतद्धिमर्शे शिवसूत्रजालम् ॥







## 2ుశో తంత్రదల్లి:-

ब्रह्मा बृहस्पतये प्रोवाच बृहस्पतिरिन्द्राय इन्द्रो भारद्वाजाय भारद्वाज ऋषिभ्यः ऋषयो ब्राह्मणेभ्यः ः






 ఱాణినియి తిశ్ష్ గ్రంథదల్లి:-

येनाक्षरसमाम्नायमधिगम्य महेश्वरात् ।
कृत्स्नं व्याकरणं प्रोक्तं तस्मै पाणिनये नमः॥ ॥
 ఎన్ను జెలెదేనెండు తితిడు బరుత్తది.

तत्राद्यं ब्राह्ममुदितं द्वितीयं चान्द्रमुच्यते । तृतीयं याम्यमाख्यातं चतुर्थं रौद्रमुच्यते ॥ वायव्यं पन्चमं प्रोक्तं षष्ठं वारुणमुच्यते । सप्तमं सौम्यमाख्यातम् अष्टमं वैष्पवं तथा।



राब्दाम्बुधिं प्रमथ्यैव रांकरेण यदुद्धृतम् । माहेरां ताद्विजानीयात् क्त्स्नं व्याकरणामृतम् ॥




## ద్యాచరణాఁ్యయయన:-




 జా్ణన్ లాబీగళు.






 జన్ను ళేళినంతె విభాగిసుతల్తరర.

ง. ఎరడేనెయదాగి யలణిని యుగ.
 వ్రుడు అత్యైత్య.

## షిలదలనేయుదాగి షాణినియు షృజణయుగ:-






 ఎిభాగగలాగి ఎింగఆేసబळుడు.

ก. யెర్రిలు $2_{య} \pi$,
ง. ఎ్లారరణగళు,
2. కిซ్ష్ గ్రంథగళు - ఎంబుదాగి.

## Ш్రకిలాబ్యుగజు:-











○. ऋक् प्रातिशाख्यम् ।
๑. वाजसनेयी प्रातिशाख्यम् ।
2. साम प्रातिशाख्यम् ।
§. तैतरीय प्रातिशाख्यम् ।
भ. मैत्रायणीय प्रातिशाख्यम् ।
ᄅ. अथर्व प्रातिशाख्यम् ।

 యాస్ప్రిగింత బळళ ఃందేయిల ळుట్టిడె ఎండు లిద్టాంసర ముత. ముత్తు










 పిజయగఆన్ను అల్లిగళయయబంతిల్ల.














 ఇజ్టెల్ల ఇద్దేరృ ఈగిన ఆధునిచరు ము2్యిఎాగి ఎంటు జన ట్యియాశరణణరన్ను
 చరణరు,

इन्द्रश्रन्द्रः काइाकृत्स्नापिशाली शाकटायनः।
पाणिन्यमरजैनेन्द्राः जयन्त्यष्टदि शाब्दिकाः ॥

 చండంతిญె:-

## 

 నంండు యుశ్తంత్రదిండ తిఆియొత్తది.

ब्रह्मा बृहस्तपये प्रोवाच
ఆదరె ఈ ఎ్యాచరణపు నముగి దొంరళల్ల.

## 9. బలळః శ్ట్ర్య్య Ш్యాచరణ


 ిిఅిచుబరుత్తగగ.

बृहस्पतिः इन्द्राय ।
बृहस्पतिरिन्द्राय दिव्यं वर्णसहसं प्रतिपादोत्तानां राब्दानां राब्दपारायणं प्रोवाच ।

## 2. ఐంద్ర Ш్యాచరణ


 నిలడుత్తむి.







ఎాయుబ్య ఎల్యాచరణఐు భరద్ల్టాజ బుశ్తంర్రదల్లి भारद्वाजः ऋषिभ्यः ఎంబ



"तस्य यानि व्यञ्जनानि तच्छरीरम् । यो घोषः सः आत्मा । य ऊष्माणः स प्राणः। एतदु है वेन्द्रो भरद्वाजाय प्रोवाच " ఎంబ ఎాశ్య సШొదాయుగఆు



त्रुणाञ्जयो भारद्वाजाय ఎంబ ఎాయుఱ్లరరణణడ ఱూరినంతే త్రుణం


भृगुणा अभिहितं शास्त्रं भारद्वाजाय पृच्छते
 ఎండు ముळుభారతదల్లి లుప్తృలాగిడి.
 ఎస్ను ळొలిద్దాని.

## §. భాగురి ఎ్యాచచణ

वष्टिभागुरिरल्लोपमवाप्योरूपसर्गयोः।
आपं चैव हलन्तानां यथा वाचा निरप दिरप ॥




## भ. Шలరయయణ ద్యాచ్రణ

 బూరాయుణనన్ను

कम्बलचारणीयाः ओदनपाणिनीयः घृतरौदीयाः

 Шస్ను లుల్లిల Dిసుత్తానా.

## 


इन्द्रश्नन्द्रः काराकृत्स्नापिशाली शाकटायनः।
पाणिन्यमरजैनेन्दाः जयन्त्यष्टादि शाब्दिकाः ॥ ${ }^{2}$

 చరరరాదు ఎామునజయాదిత్రు,
"अयोध्यायाः परिमाणम् अस्य सूत्रस्य त्रिकं काशाकृत्स्नं ।
त्रिका काराकृत्स्ना:"


## 2. ฝ్యియాఖ్రుజేద్య ఱ్యాచరణ


 బరుత్తడి.

## మూధ్యంంది ఱ్యాచరచణ:-

सम्बोधने तूरानसस्त्रीरूपं
सान्तं तथा नान्तमथाप्यदन्तम् ॥ मध्यन्दिनिर्वष्टि गुणं त्विगन्ते नपुंसके व्याघ्पदां वरष्टिः॥
చరలిచాపృత్తియల్లి చరరిశయల్లి మూధ్యందినియన్ను ळేసంసిద్దానే.

## 8. రౌథి ఎ్యృచచచణ

ఎుळలభాజ్యబడల్లి "घृतरौढीया:" ఎంబ లుळాळరణ 山ుత్తు "घृतप्रधान:
 యున్ను లిజ్య్యరు ఆత్రయిసిద్దరెందు ఇదరింద తిళిడు బరుత్తడె.

## 9. चౌనః ద్యాచెరణ


अधीते शौनक: ఎంబ 山ూతు బరుత్తై. ఇదరింద ఇఎస ఎ్యలచరణఐు


## 10. గౌతము మ్యాచ్రణ

Шృలంజలియు Шుळలభాజ్జ్యల్లి "आपिशालपाणिनीयव्याडीयगौतमीया:"





## 11. ప్యాa పంగ్ర గ్రంఖ








## 


 उपदिशयते सा शिक्षा ఎండు ळึఆిద్దారె. ఆద్దరంం
"उदान्तानुदान्तस्वरितप्रचयाख्यस्वर-हृस्व-दीर्घ-प्लुत
अनुनासिकानुनासिकादिभेद-भिन्नवर्णसमुदायात्मपदोच्चारण
प्रकार-बोधको ग्रन्थोऽयं पाणिनीयशिक्षा इति नाम्ना भिधीयते ""

- ఎందిరుబ్రుదరిండ







## నిరుచ్తి:-

 రలఖి. ఇడు బెలదాంగగఆల్లి ఒందాగిడ్దు బొలడ ముంత్రగళ అథ్గళస్ను



 డా2లలగి అత్రంయత ముळత్ట్రదేనిసిది.



## ఱాణినియయగ:-






 ग्रामः सोऽबिजनॉऽस्यास्ती इति शालातुरीयः तत्रभवान् पाणिनिः" ఎందిరుఐ్పుదठిండ








## 










 యూత్ర అనుధధారణణాగిడి.


















## మాణినియి ఎ్యాచచరణ-అష్ట్ట్రా్యాయిల:-

ఇడు 山ృణినియిండ రజితఱాడ గ్రంథ. ఱలణినియు ఎ్యాచరణ గ్రంథ




"त्रीणि सूत्रसहसाणि तथा नव रातानि च ।
षण्णवतिश्र सूत्राणां पाणिनिः
कृतवान् स्वयम् ॥" ${ }^{\circ}$
ఎంటు అధ్యాయగళస్ను ఎరడు భాగగగళాగి ఎింగఱిసుతార్తర.
○. ఎిభజనాత్రళ భాగ [అధాయ్యయ $\Omega-2$ ]

ఎరడనియ భాగదల్లి ధ్ట్రనలాస్త్రే్రల उబ్దలాస్త్రే్రృ ఒందరలిల్లండు








 నిలయదాగియిల ఇడె.

## ซాత్య్యయసన:-


 దల్లి \&oగగ ळొతిరుఎను-
"उत्तानुक्तानदुरुक्तानां चिन्ता यत्र प्रवर्तते ।
तं ग्रन्थं वार्तिकं प्राहुः वार्तिकज्ञा मनीषिणः॥"
ఎాతిశచపు ఎ్యాశరరణదల్లి లుశ్త, అనుశ్త ఎుత్తు దురుశ్తృాద ఎిజయయ


むతంజలి:-


 ఒను.







 యున్ను సెటుథF సెలలగిడి.









-. అఱ్ట్టధ్యాయిగగ ఒరేద Шృత్తిగళు.
2. అఱ్ల్టధ్యాయియ ట్ర్రియా శ్రైు.








## అఱ్ట్ట్రా్యయయిగి బరాచ పృత్తిగళు:-




 దిత్యరర ซృలిశా.

## 




 noeo.

 ஹீంందిది.







## ఱలణిస్యుత్తర యుగ：－




○．చౌతంత్ర ఎ్యృచ్రణ．
๑．ひౌండ్ర Ш్యర్రరణ．
2．జృసెనంద్ర ఎ్యాచచరణ．
ఆ．गలもళృయున ఎ్లాశరణ．


2．సిద్ధळేలముహబ్దానులాసస．

## ఎ్యాచరణలాప్త్రే జ్రీయిలజనగజు：－



 డల్లిది．
＂प्रयोजनम् अनुद्दिशय मन्द्रोऽपि न प्रवर्तते ।＂
ळలగ゚యొల，

> "सर्वस्यैव हि शास्त्रस्य कर्मणो वापि कस्यचित् । यावत् प्रयोजनं नोक्तं तावत् तत् केन गृह्यते ॥"







 చండంతిబి.

## ద్యాచచరణద జ్యయయจఁజనగఆు:-










 ஹూడలఆఁబొలపు.



 ఎ్యాశరణద అధ్యయనదింద उబ్దగళన్ను అల్బచలదల్లియిల కిళియబळు


असन्देहः-యよజ్ఞچचठు "स्थूलपृषतीमाग्निंवारुणीमनड्वाहीमालभेत " ఎండు





 లుద్బబిసుత్తడి.






"साधुराब्दप्रयोगवशात् अभ्युदयोऽपि भवति । तथा च कथितं कात्यायनेन शास्त्रपूर्वके प्रयोगे अभ्युदयस्तत्तुल्यं वेदशब्देन इति। अन्यैरप्युक्तम्" ${ }^{\circ}$
"एकः इब्दः सम्यग्ज्ञातः सुष्टुः प्रयुक्तः स्वर्गे लोके कामधुग्भवति इति ।"פ




 డల్లి ळొఆఆలలగిది.

दुष्टः शब्दः स्वरतो वर्णतो वा मिथ्या प्रयुक्तो न तमर्थमाह । स वाग्वज्रो यजमानं हिनस्ति, यथेन्द्रशात्रुः स्वरतोजपराधात् ॥ ${ }^{2}$










"यस्तु प्रयुङ्के कुरालो विरोषे इाब्दान् यथावद व्यवहारकाले सोऽनन्तमाप्नोति जयं परत्र वाग्योगविद् तुष्यति चापशब्दै ॥"




"चत्वारि श्रुंगा त्र्यो अस्य पादाद्वे रीर्षे सप्त हस्तासो अस्य
त्रिधा बब्दो वृषभो रोरवीतिमहो देवो मर्त्याम आविवेशा।",






"चत्वारि वाक्परिमिता पदानि तानि विदुर्ब्राह्मणा ये मनीषिणः।
गुहा त्रीणि निहिता नेङ्गयन्ति तुरीयं वाचो मनुष्या वदन्ति ॥" $॰$

 ికిస్సత్తడి.

उत त्वः पइयन् न ददर्शा वाचम् उत त्वः श्रुण्वन् न श्रुणोत्येनाम ।
उत त्वस्मै तन्वं विससे जायेव पत्य उराती सुवासाः ॥?






"सक्तुमिव तितउना पुनन्तो यत्र धीरा मनसा वाचमक्रत ।
अत्रा सखायः सख्यानि जानते भद्रैषां लक्ष्मीर्निहिताधिवाचि ॥"2
 ఋుందిన మ్ంత్రચు తితిసుత్తడి.
"सुदेवो असि वरुण यस्य ते सप्तसिन्धवः।
अनुक्षरन्ति काकुदं सूर्म्यं सुषिरामिव॥" ॥



"सत्यदेवाः स्याम इत्यध्येयं व्याकरणम्"

"रूपादयो यथा दृष्टः प्रत्यर्थं यतराक्तयः।
शब्दास्तथैव दृइयन्ते विषापरहणादिषु ॥ '

 ఛముఁజనచఱాగుత్తడి. ఇదన్నిల భతృశळరియు

यथैषां तत्र सामर्थ्यं धर्मेप्येवं प्रतीयताम् ।
साधूनां साधुभिस्तस्माद् वाच्यमभ्युदयार्थिभिः॥
ఎండు ळేలఆిద్దానె.


"सर्वोडदृष्टफलानर्थानागमात्प्रतिपद्यते ।
विपरीतं च सर्वत्र राक्यते वक्तुमागमे ॥"
एकः राब्दः सम्यक् ज्ञातः शास्त्रान्वितः सुप्रयुक्तः स्वर्गलोके च कामधुक् भवति ।

 ఎినంతే ఘలల్ర్రదఱాగుత్తడి.
"साधुत्वज्ञानविषया यैषा व्याकरणस्मृतिः।
अविच्छेदेव शिरटानामिदं स्मृतिनिबन्धम् ॥"






## 

" ${ }^{\circ}$ कारं पृच्छामः को धातुः? किं नामाख्यातम्? किं प्रातिपदिकम्? किं लिङ्ग्? किं वचनं? का विभक्तिः? कः प्रत्ययः? कः स्वर उपसर्गोनिपातः? किं व्याकरणम्? को विकारः? को विकारि? कति मात्रा? कति वर्णः? कत्यक्षरः? कति पद? कः संयोगः? किं स्थान नादानुप्रदा अनुकरण्म्?"०












 ఋు2్యిఎాగుత్తది ఎందు ळెల్తత్తాని.
"ससर्वेषामेव शौचानाम् अर्थशौचं विशिष्यते । योऽर्थैरशुचिः शौचन्नमृदावारिणा शुचिः ॥"

## దాల్లిలళ రామూయిణ:-

"सोऽयं नवव्याकरणार्थवेत्ता"
"नूनं व्याकरणं कृत्स्नमनेन बहुधा श्रुतम्।
बहु व्याहरतानेन न किज्चिदपभाषितम्"
ळను山ుంతను ఒంభత్తులిధవాద ద్లాచరణగళస్ను బల్లబనాగిద్దను.






 లాగిది.

## ముळాభారత:-

‘सर्वर्वानां व्याकरणाद्वैयाकरण उच्यते ।
तन्मूलतो व्याकरणं व्याकरोतीति तन्तथा।"
 ळొల్తుత్తిది.


 उठ्తలన. "भावप्रधानमाख्यातम्", "सत्वप्रधानानि नामानि" ఎండు ळొఆిద్దానె.



वागर्थाविव संपृक्तौ वागर्थ प्रतिपत्तये
जगत पितरौ वन्दे पार्वतीपरमेश्वरौ ॥




డలశ్యుజుదయ :-




अर्थप्रवृत्तितत्त्वानां राब्दा एव निबन्धनम् ।
तत्त्वावबोधः राब्दानां नास्ति व्याकरणादृते ॥


 భతృృ ळర ळలఆిద్దాని.

महता देवेन नः साम्यं यथास्यादित्येयं व्याकरणम्
तद्व्याकरणमागत्य परं ब्रह्माधिगच्छति
राब्दब्रह्मणि निष्पातः परं ब्रह्माधिगच्छति ।।




आसन्नं ब्रह्मणस्तस्य तपसामुत्तमं तपः ।
प्रथमं छन्दसामङ्ञं प्राहुर्व्याकरणं बुधाः ॥



 బిబరిసిద్దాని.

प्राप्तरूपविभागाय यो वाचः परमो रसः ।
यत्तत् पुण्यतमं ज्योतिस्तस्य मार्गोऽयमञ्जसः ॥

अर्थप्रवृत्तितत्त्वानां शब्दा एव निबन्धनम् ।
तत्त्वावबोधः शब्दानां नास्ति व्याकरणादृते ॥









"तद् द्वारमपवर्गस्य वाङ्झयानां चिकित्सितम् ।
पवित्र सर्वविद्यानामधिविद्यं प्रकाइते ॥
अपः पवित्रं परमं पृथिव्याम् अपां पवित्रं परमं च मन्त्राः।
तेषां च सामर्गयजुषां पवित्रं महर्षयो व्याकरणं निराहुः ॥"







 దెండు జా్ణినిగిల మెలఆిద్దారె.

यथार्थः जातयः सर्वाः राब्दाकृतिनिबन्धनाः।
तथैव लोके विद्यानामेषा विद्या परायणम् ॥
येकं प्रक्रियाभेदेदैबहुधा प्रविभज्यते ।
तद्व्याकरणमागम्य परं ब्रह्माभिगम्यते ॥
इदमाद्यं पदस्थानं सिद्धिसोपानपर्वणाम् ।
इयं सा मोक्षमाणानामजिह्ना राजपद्धतिः ॥

शिष्येभ्यः आगमात् सिद्धाः साधुवो धर्मसाधनम् । अर्थप्रत्यायनाभेदे विपरीतास्त्वसाधवः ॥n











नानर्थिकामिमां कश्चित् व्यवस्थां कर्तुमहति । तस्मान्निबध्यतं शिष्यैः साधुत्व विशाया स्मृतिः। तस्मादकृतकं शास्त्रं स्मृतिः च सनिबन्धनाम्। आश्रित्यारभ्यते शिष्यैः शब्दानामनुशासनम् ॥ न सोऽस्ति प्रत्ययो लोके यः शब्दानुगम्यते । अनुविद्धमिव ज्ञानं सर्वं शब्देन भासते ॥






 ఇల్లహై ఇల్ల.

"राब्दस्यैवासौ व्यापारो न्याय्यः"
ఎందిదె.

## (मुकुलभ : :)

एतेन शब्दसामर्थ्यमहिम्ना सोऽपि वारितः।
यमन्यं पन्डितमन्यः प्रपेदे कञ्चन ध्वनिम् मानान्तरपरिच्छेद्यवस्तुरूपोपदेशिनाम् शब्दानामेव सामर्थ्यं तत्र तत्र तथाविधम् ॥


शब्दरछन्दोऽभिदानार्थाः इतिहासाश्रयाः कथाः। लोको युक्तिः कलाश्चेति मन्तव्याः काव्यहेतवः॥
शब्दाभिधेये विज्ञाय कृत्वा तद्विदुपासनाम् ।
विलोक्यान्यनिबन्धांश्र कार्यः काव्यक्रियादरः ॥
सर्वथा पदमप्येकं न निगद्यमवद्यवत् ।
विलक्षणा हि काव्येन दुःसुतेनेव निन्दते ॥








 అగత్యతేయన్ను తిఆినద్దానె.
"रूपकादिमलङ्कारं बाह्यमाचक्षते परे ।
सुपां तिङा च व्युत्पत्तिं वाचां चैव तथाविधम् ॥
तदेतदाहुः सौरब्दं नार्थव्युत्पत्तिरीदृशी।
रब्दाभिधेयालङ्झरभेदादिष्टं द्वयं तु तः ॥"०

 ఎ్యాచరణహుద్ధియన్నిల హబ్దగఆిగి ము2్యిఎాద అలంచారగఆిందు తియితుత్తరరె.





## ఋચ్తాపలిల:-

"शक्तिग्रहं व्याकरणोपमानकोशाप्तवाक्याद् व्यवहारतश्च।
सात्निध्यतः सिद्धपदस्य धीरा वाक्यस्य रोषाद्विवृतेर्वदन्ति ॥"
-ఎందిద్దానె.



 హృలరిబరుత్తడ

"अनुत्सूत्रपदन्यासा सद् वृत्तिः सन्निबन्धना ।
शब्दविधेव नो भाति राजनीतिरपस्यशा ॥"
-ఎందిద్దానం
 అనిమాయుం బెంబంతే ळొంగతిద్దానే.
"‘प्रथमो वै विद्वासाः वैयाकरणाः इब्दतत्त्व मूलत्वात्"





"दीपतुल्यं प्रबन्धोऽयं इब्दलक्षणचक्षुषाम् ।
हस्तोदर्श इवान्धाना भवेद् व्याकरणादृते ॥"?




 శిళళచండుంతిది-
"अचीकमत यो न जानाति यो न जनात्यवर्वरीः ।
अजर्धाः यो न जानाति तस्मै कन्या न दीयताम् ॥"2




"शिक्षा कल्पो व्याकरणं छन्दसां चयः।
ज्योतिषामयानं चैव वेदाङङ़ि षडेव तु ॥
छन्दौ पादौ तु वेदस्य हस्तौ पल्पोऽथ उच्यते ।
ज्योतिषामयनं चक्षुर्निरकृं श्रोत्रमुच्यते ।
शिक्षा घ्राणं तु वेदस्य मुखं व्याकरणं स्मृतम् ॥
तस्मात् साङ्मधीत्यैव ब्रह्मलोके महीयते ।"



 నాథు కిలియుబळుదాగిది.
"उपासनीयं यत्नेन शास्त्रं व्याकरणं महत्।
प्रदीपभूतं सर्वासां विद्यानां यदवस्थितम् ॥",


"एकं वर्णाः प्रयोक्तव्या नाव्यक्ता न च पीडिताः।
सम्यग् वर्णप्रयोगेण ब्रह्मलोके महीयते ॥"

## ఫొలలిలరఒస తబ్దముణిదజ్ణణ:-

ప్లాచరణదంది జదమూ
ప్యాచరణద జదదిసథణముథణది తత్త్యా $\mid$




"भाषाकविनिवहोऽयं दोषाकरवद्विभाति भुवनतले."



"अस्वीकृत व्याकरणौषधानामपाटवं वाचि सुगूढमास्ते ।
कस्मिंश्चिदुक्ते तु पदं कथक्चित् स्वयैरं वपुः स्वद्यति वेपते च।",


 లుంటలగుత్తడి. ఎండు మొలలిన ひెల్లాపద అథ్.









## 















"अचीकमत्यो न जानाति यो न जनात्यवर्वरीः।
अजर्घाः यो न जानाति तस्मै कन्या न दीयताम्॥"

















## అฉిటెజ్టేణిగళు：

ก．డంఱియు ซఎప్లాదలణ

9．నిరుశ్త యానై్ర్రాలయ\％．
2．సిద్ధాంత శృముది－భజీల్టఁజిదొల్షికరు．

○．तैतरीय संहिता．
๑．सायणाचार्य भाष्य．
2．ॠग्वेद．

ค．யைణినియి కిశ్ట్రా

 Јమూ（（山్山．లల）．
 Јఱృఁ（Ш⿹勹巳．లల）．

ค．ய్రంంజలియు ముळాభాజ్య．
－．उెత్తరలయ స్ సం
2．ग్రంయణణుఙూయ్ర భాజ్య．

○．व्याकरण् शास्त्रका एतिहास्－युधिष्टि्र्मीमांसक．
9．संस्कृत्साहित्य का उद्रव् और् विकास．
2. तैत्तरीय प्रातिशाख्य.

ค. Шుळుభారత.
०. व्याकरण् शास्त्र् का इतिहास् - युधिष्टिर् ्मीमाम्सक्-चौखम्बा सीरीस्.
9. महाभारतम्- गीताप्रेस् गोरख्प्रु्र
2. पाणिनीय शिक्षा- चौखम्बा सीरीस्.
०. संस्कृत् व्याकरण् का उद्धव् और् विकास्.
9. महाभाष्यम्.
๑. Citical studies on katyayana's Suklayajurvedapratishakya; p. 10.

ค. पाणिनीय अष्टध्यायी.

ค. 2ుశ్తంత్ర.
9. ขుచ్తంత్ర.
2. Шుळాభాజ్ల్య.

๑. OASG p- 56-58, On the aindra school of Sanskrit grammarians.
2. शుచ్తంక్ర.
§. ซాలిचo.
भ. ఐతరేఁయ బల్రై్రణ.
๑. ఎాయుషులుర.

2. யెలణినియు అఱ్ల్టధ్యాయిల.

ఆ. ய్రంజలియు ముळాభాజ్యృయో.
भ. ముळాభౌజ్య్ర.

ก. யృంంజలియు ముळుభాజ్యృ
-. అథF సంగ్రెळ.


ก. ขుగ్సిలడ గాయుణ భాఱ్య భలమిచి.
9. யలణినిఁయు కిర్ష్ర

๑. A dictionary of Sanskrit Grammar, Oriental Institute, Baroda, 1961, pp. 229-30.
๑. पाराशरोपपुराणम् समीक्षात्मकं सम्पादनम्- सम्पूर्णानन्दसंस्कृतविश्वविद्यालयः वाराणसी. पु.स.९९.



๑. Ibid.
2. Ibid.

๑. Ibid.


- Ibid.

2. Ibid.
๑. युधिष्ठिर् मीमांसकः- संस्कृत् व्याकरण् ्रास्त्र का इतिहास् (हिन्दि) २००७ चौकम्बा सीरीस्.



 すమృఁ.
๑. वाक्यपदीयम्.

ค. భాముळస ซృఱ్యాలంచారృృత్తి.

ค. Шూఖ゙న కిలుఱులజధ.



2. ఈథాసెరతత్లాగర అను. ఎబో.పి నాగగరాజ రాబో யు

○. पाणिनीया शिक्षा पु. २०.
๑. उपाकार् एन्.इ.टि संस्कृत पु. ५९.
2. पाणिनीय शिक्षा पु. १६.

ก. ॠరళ Јబ్ద Шుణిడむનణ.

## प्रथमोगध्यायः <br> ద్దెకలయౌอesధ్యాయ <br> గెద్యె ळలగృ శఁథల నెఃిత్యెద లుగదు దుక్తు పికాస












## నాఙిత్య 山ుదద అథ్:-






"सङ्ञीत साहित्य कलाविहीनः साक्षात्पशुः पुच्चविषाणहीनः"०



"पञ्चमी साहित्य विद्येति यायावरीयः।
साहित्य चतस्णां विद्यानामपि निष्यन्दः ॥"?



साहित्य पयोनिधि मन्थनोत्थं काव्यमृतं रक्षत हे कवीन्द्राः । यसस्य दैत्या इव लुंठनाया काव्यार्थचौराः प्रगुणीभवन्ति ॥ ${ }^{\circ}$
 అథFగఆత్లి ఆగిది.














## నొటహళగళు:-






 డల్లి రఙఒతగగంంณిబె.

## జంష్యొ చృચ్యగఆు:-







> "‘गद्यपद्यमयी काचित् चम्पूरित्यपि विद्यते"ः

## జంష్య రామూయణణచల్లి:-

"गगद्यानुबन्ध रसमिश्रित पद्यसूक्तिः।
हृद्या हि वाद्यकलहा कलितेव गीतिः ॥"ः






 లాగిడి.

अपारे काव्यसंसारे कविरेकः प्रजापतिः।
यथास्म्यै रोचते विश्वं तथेदं परिवर्तते ॥







 ధారుటినింద గడ్యు ఎంబ రృజ్లనిజ్ట్జస్నదాగిదే.



 విరఠ.

ค. అश్యాయిచా,
ง. చథా ఎండు.
 లచ్షణగఆన్ను ఆ రొతియాగి ळొలిద్దారే-

प्रकृतानुकूलइश्रव्यराब्दार्थपदवृत्तिना । गद्येन युक्तोदात्तार्था सोच्छ्वासाख्यायिका मता ॥ वृत्तमाख्यायते तस्यां नायकेन स्वचेष्टितम् । वक्त्रं चापर वक्त्रं च काले भाव्यर्थइांसि च ॥ कवेरभिप्रायकृत्यैः कथनैः कैश्चिदङ्ञिता। कन्याहरणसड्ग्रामविप्रलम्भोदयान्विता ॥ न वक्त्रापरवक्त्राभ्यां युक्ता नोच्छ्वासवत्यपि ।

संस्कृतं संस्कृता चेष्टा कथापभ्रंशाभाक् तथा।
अन्यैःस्वचरितं तस्यां नायकेन तु नोच्यते ।
स्वगुणाविष्कृतिं कुर्यादभिज्ञातः कथं जनः ॥
నిరిటిసిరు山ంత లలిత 山ుత్తు 山ుఢుర హబ్దథథ్గఖిండ తుంబి








संस्कृतानाकुलश्रव्यइाब्दार्थपदवृत्तिना।
गद्येन युक्तोदात्तार्था सोच्छ्वासाख्यायिका मता ॥ ${ }^{n}$







＂वक्त्रं नाद्यान्नसौस्यातामब्धेर्यो नुष्टुभि ख्यात＂＂2
ఎండు ळீలిడె．






 ఇరుబుదిల్ల.

## もథా లచ్షణ:-

"न वक्त्रापरवक्त्राभ्यां युक्ता नोच्छवासवत्यपि ।
संस्कृतासंस्कृता चेष्टा कथाप्रभंराभाक्तथा।"
"अन्यैः स्वचरितं तस्यां नायकेन तु नोच्यते ।
स्वगुणाविप्कृतिं कुर्यादभिजातः कथं जनः ॥",










वैदर्भमन्यदस्तीति मन्यन्ते सुधियोडपरे ।
तदेव च किल ज्यायः सदर्थमपि नापरम् ॥ ${ }^{\wedge}$



अस्त्यनेको गिरां मार्गः सूक्ष्मभेदः परस्पर्ं। तत्र वैदर्भगौडीया वर्ण्येते प्रस्फुटांतरौ ॥


 యూత్ర ఎిబరిసుత్తెలబె. ఎండు ळోగతి

इलेषः प्रसाद समता माधुर्यां सुकुमारता।
अर्थव्यक्तिरुदारत्वमोजः कान्तिसमाधयः ॥

इति वैधर्भमार्गस्य प्राणा दरा गुणाः स्मृताः।
एषां विपर्ययः प्रायो दृरयते गौडवर्त्मनि ॥ ${ }^{2}$


 బరుత్తడద.

अकठोराक्षरं स्वल्पसमासं वृत्तकं मतम् ।
तत्तु वैदर्भरीतिस्थं गद्यं हृद्यतरं भवेत् ॥ ${ }^{\Omega}$

 ఎిల్టనలథను ळొలిద్దానే.
ஹைంజూలి:-




## $\pi{ }^{\top}$




 ప్తడి.
"अग्निर्वै देवानामवनो विष्णुः परमस्तदन्तरेण सर्वा अन्या देवता । अग्नावैष्पवं पुरोडाशां निर्वपन्ति दीक्षणीयमेकादराकपालंसर्वाभ्य एवैनं तद्देव ताभ्योऽनन्तरायं


## ఎిజ్ణుய్రురాణదల్లి:-

"यथैव व्योम्नि वह्निपिंडोपमं त्वामहमपइयं तथैवाद्याग्रतो गतमप्यत्र भगवता किज्चिन्न प्रसादीकृतं विरोषमुपलक्षयामीत्युक्ते भगवता सूर्येण निजकण्ठादुन्मुच्य स्यमंतकं नाम महामणिवरमवतार्य्स् एकान्तेन्यस्तम् ${ }^{\circ}$.




 ద్దాగి రひతగగంంఱిబె．






 బळుడు．


 థ్రుదు ష్ల్రజలతతపాయితు．


 ＂गद्यं कवीनां निकषं वदन्ति＂ఎంబ దంఙయ లుళ్తయు ఱ్రుజలితదాయితు ఎండరర తేల్టలగలలరదుు．

సంతరదల్లి బ్ర్ర్మణగఆల్లి బరు山 గద్యదల్లి బ్యచ్తఱాగు山 ఆఖ్యాన


＂सत्यं वै चक्षुः। सत्यं हि वै चक्षुः। तस्मात् यदिदानीं द्वौ विवदमानावेयान्ताम् । अहमदर्शाम्，अहमश्रौषम्＂०
" हरिश्शन्द्रो ह वै घस ऐक्ष्वाको राजाउपुत्तासा तस्य ह रातै जाया बभूवुः। तासु पुत्रं न लेभे । तस्य ह पर्वतनारदौ गृह उव्पन्तुः। स ह नारदं पप्रच्छ इति M "







 జుదడల్లి అభిబ్యే్త మూడిబळుడు.






## "ओजस्समासभूयस्त्व मेतदगद्यस्य जीवितम्" $\cap$

## అనుజులబ్ధ గద్యద రజనిగెళు:-




 గద్యద లుక్హృ ష్ట్లాద లుదాळరణణయయాగిదే.
"आख्यानाख्यायिकेति हासपुराणेभ्यइच" ఎండు ఆ2్యయన 山ుత్తు ఆ బ్యాయయిక్ర
 प्रियङ్య श्र ययाति" ఋొంతాడప్రుగళస్ను ఆఖ్యానగఆ లుదాळరణణయాగియిం


 నెంబుడు సిద్ధలాగుత్తడి.

सा रसवत्ता विहिता नवका विलसन्ति चरति नो कङ্कः। सरसीव कीर्तिरोषं गतवति भुवि विक्रमाद्दिये ॥
"कवीनामगलद्दर्पोनूनं वासवदत्तया" $\bigcirc$
ఈ నిక్టైల్లి ఎరరుజయు ఙలరుఱుతియన్ను, ర్రిలఱలితను తరంగముతి



तौ शूद्रककथाकारौ रामिलसोमिलौ ।
काव्यं ययोर्द्वयोरासीदर्धनारीश्वरोपमौ ॥ ${ }^{\curvearrowright}$
 గఆస్ను ळేసరిలద్దానె.



पदबन्धोज्वलो हारी कृतवर्णक्रमस्थितिः।
भ र् हरिचन्द्रस्य गद्यबन्धो विभाव्यते ॥?
ఈ రెల్లలచదింద తిలిదుబరుత్తడి.






## గద్య อాపసగఆు:-



"कनकरजतवज्रवैडूर्य रतोपचयविष्यन्दमानकोशोन स्क्उतलधुमधुर चित्रकांतशब्द समयोदारालंकृतगद्यपद्य (काव्यविधान प्रवीणे) न प्रमाणमानोन्मान स्वरगतिवर्ण

साज्जत्त्वादिभिः परमलक्षणव्यञ्जनैरुपेत्तकान्तमूर्तिना स्वयमधिगत महाक्षत्रपनाम्ना．．．म् पेत । इत्यादि ${ }^{\circ} \cap$









＂‘तस्य विविधसमरशतावतरणदक्षस्य स्वभुजबलपराक्रमैकबन्धोः पराक्रमाँकस्य परशुइाररांकुराक्तिप्रासासित्तोमरभिन्दि पालनाराच वैतरिकाद्यनेकप्रहरणविरूढाकुल व्रणशातांकशोभासमुदायो चितकान्ततरवर्ष्मणः．．．महाराजाधिराज श्री समुद्रगुप्तस्य．．．स्तम्भ इत्यादि．＂





## 

సుబంఝు：－



 బలణను ఇజన 山్రులంసెయున్ను Шూఙిరుひ్రుదరంద బలణనిగింత 80దిన山 నెందు తిళిడుబరుత్తడి．
＂कवीनामगलद्दर्पः नित्यं वासवदत्त्रया। राक्तेव पाण्डुपुत्राणां गतया कर्णगोचरम् ॥＂
 తితిదుబరుత్తడ". ఎాసెదదత్త గ్రంథదల్లిన "विफलमेव दुष्यन्तस्य कृते दुर्वासस:
 ఎిజయదల్లి "कामसूत्र विन्यास इव मल्लनाग घटित कान्तारसामोद:" ఈ ఎాశ్యై



 బరుత్తడి.

## దాపదదత్తా:-













 రీలలరబరుత్తగగి.

## బอణభష్ట్టె:-







 యన్ను யలడేదిబె．

## ఫృతిగఆง：－

ก．శేంณొతతも
9．யెఎF
2．ळぁ ఔరేత
§．モ๐డంబరి


 ేూందిరుఱుదాగిడి．




సంం్స్రృ







 ఎిద్ట్జజరంంద ఱూన్యబాగిడి．













ఆఙూయ్ర యోతు, "ताम, अतिनर्मतैव ते कथयति गुणानांगौरवम् । सकलसंपत्पात्रमसि । विभवानुरूपास्तु प्रतिपत्रयः । जन्मनः प्रभृति अदत्त दृष्टिरेवास्मि स्वापतयेषु." ठəజన ஹోతు, "भगवन्! अनुरक्तेष्टपि शरीरादिषु साधूनां स्वामिन एव प्रणयनः । युष्मद्दर्रानादुपार्जितमेव चापरिमितं कुराल जातं ।अनेनैवागमनेन स्पृहणीयं


## 






 జెడేదిద్దానె.







 య०ठ "दिवृत्वात् अपरिज्ञायमान वयः प्रमाणामपि अष्टादशावर्षदेशीयामिव उपलक्ष्यमाण"





 ఈృతిగళు.


దం玉:-






 గ్రంథజన్ను బరేదిద్దానా.







"त्र्योऽग्नयस्त्रयो देवास्त्रयो वेदास्त्र्रयो गुणाः।
त्रयो दण्डिप्रबंधारच त्रिषु लोकेषु विश्रुताः ।।"
 ఆదరా అఱు డిలరేతిల్ల.

## దతృむమోరひరిత:-


















## ధసష్ల:-



 నిలయి ఓజీలఁయుశ్తటాగిడి.
 గ్రంథఎన్ను బరేదిద్దానే. ధారలసగెరయ డిอరేగళాగిద్ద సిలయయ ముత్తు
 ஹుంజరుజ ळలగం అఎస నంతర బండ భాలజరలజన ఆజతితలఎధియల్లి


 అలల్లిలబిసిద్దానె.

## 3ిలఈముంజరి:-





तज्नन्मा जनकांघ्रिपङ्जजरजः सेवाप्तविद्यालवो ।
विप्र: श्रीधनपाल इत्यविशादामेतामबध्नात् कथाम् ॥ अक्षुण्णोऽपि विविक्तसूक्तरचने यः सर्वविद्याब्धिना ।
श्री मुञ्जेन सरस्वतीति सदसि क्षोणीभृता व्याहृतः ॥ ${ }^{\Omega}$


## ఇळస ఇతర చృతిగళుక:-




 బ్యూతనాదేను





"एकैकराः प्रकीर्णःः मुक्तामणिभिः किमेभिरेभिस्तु । यस्सृजति हन्त हारं तस्मान्यः कोऽपि परिभोगः ॥ ${ }^{\circ} \bigcirc$

ఎంబిల లుర్తియు అభిబ్యచ్తగింఖిసుత్తడి.
లుదయిసుందరి もథల:-







ఎాదొభఃంळ:-





## గద్య జింతాముణి:-











## మూధమానలచథా:-

ఈ శృతియి చతృృ ఆనందథరర. ఈ శృతియు nంనేయ లతమూనశ్రింత




## 





 నినెరణియిది.

## ృృ్ణజఔరత:-

ఈ శృతియ శ్రృృ అగే



 అఎఙ઼ేలలగిదె.

## దాయుసభట్ట్ర బలణ:-



 విలరనారాయణ ఔరత’’ ఎంబ గ్రంథసన్ను రఒిసదను. ఎంబుదు-
"बाणकवीन्द्रादन्येकाणाः खलु सरसगद्यसरणीषु । इति जगति रूढयरासो वत्सकुलो वामनोऽधुना मार्ष्टि ॥n


ఈ గ్రంథదల్లి బూణను ळజ్యయరతదల్లి తన్న ఆత్రయదలతనుద



जयशब्दः विश्वविश्वम्भरा पालमौलिमालामकरन्दसुरभितचरणारविन्दो जयन्ति विश्वाधिक


## దెలపవిజయుగణణ:-


 అనుసైిసి ఈ ఈృతయయన్ను రజిసిద్దానే.

## ిిరుములాఙాయయ:-







విల్టిల్టర మాండిఁయ:-




## ముందార ముంజరి:-









## కిమ్మి చవి:-






 ळలఱు గ్రంథగళస్ను బరేదిద్దానే.

## అంబిచాదత్త ఎ్యాస్స:-



 దిగ్టిజయుద ఎణణనియై ఎణ్యఁ ఎస్తుఱాగిది. ఐతిదాసిళ ఎిజయయగఆన్ను









 షొలా జసతేగి నిలడుక్తిడ్ద్రర.






 ¡ంగ్రఃేసల
 कथ-वाक्यप्रबन्धे- (चुरादि गण उभयपद)



## 



















 ఎందేరి తఱాగ్టగలారడు.











 జీలఁస్సరు అభిఱ్ర్యయు జడుత్తరరి."




 బిఁజరింజులల్లిది.

## 










 ఎంబ గ్రంథఱన్ను రజిలద్దానొ.

లుజనిష్మక్తుగళల్లి నాయిగఆు తఱుగింబ్బ నాయయశనస్ను ఐుడుపుత్తృె.

 ఈథుజాలదల్లి ఐిణియల్టట్టిదె．








 డ్ధెలతవాగిరుత్తడి．





 earliest times of the life of the vedic Indians in India tales of all sorts passed current amaong the people，however useless it may be to discriminate them as fairy tales．Merchan，or Myths or Fables in the earlier stages of their development．＂

## 


ค．బృळత్రథథల，

2．బృळక్ర్థలుుంజరి，
ఆ．もథౌసరంతల్సగరె，
भ．జ్రంでతంత్ర．

2. Јంత్ర,2్య్యయయి,

๒. उుచ


## బృळత్మథథా:-














सत्यं बृहत्कथांभोधेर्बिन्दुमादाय संस्कृताः।
तेनेतरकथाः कन्थाः प्रतिभान्ति तदग्रतः ॥ ॥




| చవి | - तौణ口ఢ్య |
| :---: | :---: |
| ఇఎన ซృల |  |
| ఆత్రంయదలత | - నుతరాఠన |
| భอజ |  |













 ఎందిగృ శందేలశ山స్ను ఐోంందిల్ల.

## గుణాఢ్య్యన్ను స్తుతిసరుజ భారతిఁయ చవిగఆు:



 "బడ్డూもळల" ఎంబ ळేసరనింద స్తుతిసలాగిడి.
‘सयल-कलागमणिलया सिक्खाविय कइयणस्स मुहयंदा।
कमलासणो गुण † सरस्सइ जस्स बड्ढ्कहा ॥" ${ }^{\circ}$

 రిః్షితరాగుత్తరరె."

## బాణభష్టను తగ్న ఐడ్టఁఒరితదల్లి:-

"समुद्दीपित कन्दर्पा कृत गौरीप्रसाधना ।
हरलीलेव नो कस्य विस्मयाय बृहत्कथा।।"



 స్ట్రయం రజజిడిను", ఎండు ळొలఆలలగిడి.
"शब्दावतारकारेण देवभारतीनिबद्ध बड्ढ्कथेन
किरातार्जुनीये पञ्चदशासर्ग टीकाकारेण दुर्विनीत नामधेयेन..."2.


"पारदः स्थिरकल्याणो गुणाढ्यः प्राकृतप्रियः।
अनीतिर्यो विशालाक्षः शूरो न्यकृतभीमकः॥"४

## \#థాळే్తు:-

















## బృळ్త్రథథ ముంజరిఁ:-







## ేథాळస్తు:-









"‘यामूलं तथैवैतन्न मनागप्यतिक्रमः।
ग्रंथविस्तरसंक्षेपमात्रं भाषा च भिद्यते॥
औचित्यान्वयरक्षा च यथाइाक्ति विधीयते ।
कथारसाविघातेन काव्यांशास्य च योजना॥"






 చడీయజ్ష ero\&in త్తరర. 0 "I do not think it would be an axaggeration to estimate the whole lengh of the poem of 25000 verses at least, divided into more than 100 sargas."

## ఈథాసరితాగ్లాగర:-

|  |  |
| :---: | :---: |
| ఇఎన చృల |  |
| ఇఎన ఆత్రయుదాతగు |  |

## ఈథాఱస్తు:-







पवित्रतरङङभङ्गी कथासरित्सागरो विरचितोऽयम् । सोमेनामलमतिना हृदयानन्दाय भवतु सताम् ॥





 "ఈథుమృత"
 nature, the elegance of his style, the beauty and farce of his descriptions and the wit and wisdom of his aphorisms are masterly in their execution" ఎండు ஹீలగళిద్దానే.

## జంజేకంత్త:-



 జగత్తిన నానా భాష్జగఆిగ అనుఱాదగగంంఱిరు山 శృతిగళల్లి ఇడు అద్టికియయ



$$
\begin{aligned}
& \text { ేతృృ - విష్ణ్లులముఁ } \\
& \text { ซృల - ఫ్ర..ర. 2నియ తతఱూన }
\end{aligned}
$$

## ేథాఱష్తు:-







⿷匚ల్రెఁతియిడా.















"ववातवृष्टिविधूतस्य मृगयूथस्य धावतः।
पृष्ठतोऽनुगमिष्यामि कदा तन्मे भविष्यति ।"ः



एकः सखा प्रियो भूयः उपकारी गुणान्वितः।
हन्तव्यः स्त्रीनिमित्तेन कष्टमापतितं मम ॥จ

## 


 నారాయణ யుంణితను. ఇ山ను ధహళజంద్రన ఆన్థ్థనదల్లిద్దను. ఇవస





## చథాఱష్తు:-









## సింఠ0మస ద్ర్ట్రింలిచా:-




 యల్లి ఐృళలారితు. ముందే ధారానగరయయ భాలeజను భామియల్లి తనగగ




## తంత్రలలִాల్యాన：－




ก．సందేむ్రైరణ，
－．ذं
2．ஹుండృも 戸్ర゙もరణ－ఎందు，




 ఇదన్ను రఔేసలలాగిడి．

अर्थे भवेन्नयज्ञानमाख्यान श्रवणे सुखम् । ज्ञानार्थं च सुखार्थं च तन्त्त्रोपाख्यानमुच्यते ॥＂०
－ఈ లెల్లాదదండ బెలడ్యఎాగుత్తది．
 ఆడ 山ుఙత్త్యబస్ను ஹూందిది．ఇడర ఆధారపన్న్నిసిచింండు జాబా，
 యున్ను సైఒఒసుత్తడి．


 யుడుత్తారె．

## をథలぁస్తు：－






 రలతియుగి 20 ซథiగళన్ను Dలతితు.

## జెల తాళ్ జుంజేిింతక:-








 గురుతిసెలు ఇడుజరేగం నాఢ్యనాగిల్ల.

## ఈథాపస్తు:-














## జ్లిన ఈథానాఠిత్ర్య:-




ค. భరటహ ద్ర్ట్రింలిఈం
๑. ண్మేములిజయున ఈథారత్న్ చర







 దాడ ఈ ట్రుబంధగళు బఱుజనむ్తియమాగిబి.


2. జ్రుబంగ జంతాయుణి


 అధిరారేగఆిఱె.

9. జుద్లనాభ ముత్తు ధముఃరుజియ జరిత్ర.

 లอభ.

भ. ซృమున దిగ్టిజయి.
๖. ఎిజయశ్గ్రిగి ఎిఱిలzద యాత్ర.
2. షిలఁळ ముత్తు బిఱెలz.

## బొద్ధ్ చథాశారిత్య:-










 ఇదరల్లి నిలతియ 山్రిత్లుదనింి అధిచలాగిది.




































 జనాంగెద చణ్తెరేసిద శృతి.










ఆంగ్ల భాజేయల్లి "Don't simply transmit information and hope it is received and understood. Weave that information into a story and it is more likely to persuade people to behave the way you want them to."
"Story telling is the heart of communication. No other Narrative structure can move hearts and minds in the way that a well crafted story can, stories are part of our collective unconscious."










## అฐిళెష్టణణిగళు:

०. नीतिशातकम्- भर्तृहरि:
๑. साहित्यदर्पणः- राजरोखर-पु.


ก. Шంณియు ซఎప్లాదహల గ-2.

ก. జఈయய్ల రామూయణ $\cap-ల$.
๑. భాముळే ซృద్యలలంచూర,
๑. スై

-. భండేอలనులాసేస.





2. Ibid.
e. Ibid.

-. ङృత్రరఁయ స్లంఃలె.
๑. संस्कृत् साहित्य का उद्भव् और् विकास्.
०. संस्कृत् साहित्य का उद्भव् और् विकास्







 బేంగఆృరు. 9002.




○. Da. Rhys Davids; ottokeller.




§. संस्कृतसुकवि समीक्षा. बलदेव उपाध्याय- पु. २४१-२५३. वारणासी-१९६३.
๑. A History of Sanskrit Literature.

○. कथासरित्सागर एक विमर्शात्मक् अध्ययनम्.


ค. అంతజాรలడ నేరేు.

## प्रथमोगध्यायः <br> కృైయాoesఅధ్యాయ

## దల్యలరణణలుస్త్రేద బిలeధేనియు టీలగలఁంతేరేగెళు

 దుత్తు
## స్రిలరలములురెణత్రిడుఠిల లలస్త్రిగెళ ఉరిఙయయ




















 నిలడువుదెల తృతిఁయి అధ్యర్యుద గురయయృగిది.



 సంస్ప్రృత సారిత్య ఇకిఠాససదల్లి అజరుజురరుగిద్దారె.

 ఎ్యా2్యలనాదిగళిอందిగి ఎిలాలఱాగి బెళిడు బందితు.

ముత్తు ఈ అధ్యాయుదల్లి నన్న స్తైలథనియు ఆళరగ్గంథృాగిరు山





 ఱూఱిపిండలలగగుపుడు.




2. దలలణనిప శ్రులు

அ. గడ్యదల్లి చథాడూథ్యబూ

## 








 ఎ్యాచచరణశృతియాగిది.










 అఱ్రుగల్లి ఋుబ్యిఎాదేు ఈ శిళగినంతిఱె.




## 





 యాగిది.





 అనిలశరు గ్రంథగళస్ను బరేదిద్దారె. ఇబెల్లఖ్యం లాస్త్రై్లెలియన్ను మిలరరు జుదిల్ల.
 అత్యంత జ్లిసద్ధియస్ను ळొంందిడ గ్రంథఱాగిడి.











 గైంఠిబె.




ค. ధముళซఁతిఁయ రృఱలఎతార.
9. విముల సెరస్ట్రతయయ బరేడ రృజ్టూలా.
2. రాముజేంద్ర్రబయయ్ర ట్ర్రయయా శామొది.




## ก. ひอఱూひతార:-






＂It is thus evidently one of the earliest attempts to present the grammatical aphorisms of Panini in their practical application to the various linguistic processes of Phonetic modification，inflexion and word formation
 ఎాగిది．

## 





## ก．రృజమూలా：




## ง．ひ్త్రియయ శౌముద：








## 2．ప్లియోచరణ సిద్ధాంత శ్రొమొి：






## \＆．Шొ్య సిద్ధాంత ఫొఋొి：

ఈ గ్రంథబు 山రదారాజాひాయిను బరేదిద్దానె．ఇదు సిద్ధాంత
 ేఠిమిగైఃిసిద్దాని.

## भ. లझึ సిద్ధాంతきొమొద:






## 














 ట్ర్ర్యాయనుసెరాఱాగిడి.












 యాయితు.",

## జాంద్రహ్య్యాపరణ:-







"सिद्धं प्रणम्य सर्वज्ञं सर्वीयं जगतो गुरुम् ।
लघुविस्पष्ट सम्पूर्णमुच्यते शब्दलक्षणम् ॥",

## జ్మినిఁంద్ర ఱ్యృచరణ:-




 బిద్ట్టాంస్లంంు ఐింగిిద్దారె.







 ఈరిసుజుడు డెలజనందియ జ్ర్లు2 లుద్దితఱాగిడె.

## లอఫీఠయయన ఎ్యాచచణ:-











## 戸రస్ట్యతి శరాభరణ:-



















## సిద్ధ ஹొమోనులాశస:-


 బిరుదస్ను யలజేదజనాగిడ్దను.

 నాగిడ్దు ఈ ఎల్లా బిజ్యయగఆ మెల శృతిగళన్ను రజసిద్దానే.










## చుమోరేాలజరిత:-






 గ్రంథద ముతేత్తండు బ్లెలిల్ట్ట్ర






 ఆయాముళ్ప్ జన్లనిలి ఐొలుజంద్రును అద్టికిఁయనాగిద్దానె.
నారస్స్టత ద్యాచరణ:-















 ఎంబుపుదాగిడి.

## దాతఁనిచ్ ఫ్రుమ:-











 ひూలఱాగిది.
"ओमित्येतदक्षरमिदं सर्वंवागेव विश्वं भुवनानि जज़े ।
सैषा स्पर्शोष्मभिर्व्यज्यमाना नानारूपा भवति, वाचं धेनुमुपासीत।"




 అభిఱ్ర్యయజుతుత్తరరె.








ఱాశ్యృయదొయయ:-




















## 



 ఎరడు సొひద్దిలతగఆు డిలరఃల్ల.









 సిగువుదిల్ల.


"अनाधिनिधनं ब्रह्म राब्दतत्त्वंयदक्षरम्।
विवर्ततेर्थभभावेन प्रक्रिया जगतो यतः ॥"
 సృష్టియాగిడి. ఎందేథ్



"‘प्रायेण संक्षेपरुचीनल्पविद्यापरिग्रहान् ।
संप्राप्य वैयाकरणान् सङ्ग्रहे डस्तमुपागते ॥"

 ేేళేగిసంతిజె:















 గ్రంథగఆు ఆంగ్ల భాజీయల్లి రఒతగగంండేప్ర.






 ซีళగినంతిబి:-
 ఎండో మిలనింగా",
 గ్రలురా",












## ※ద్య చ్రమ్య:-




ค. భ゙త్టియ "రాఐణబధ""
9. భట్టబిభిమున "రుఖ్లాజుఁనిఁయ""

## భళ్టియి "రాజణపభ"’:-





ซాల, దెఁอాది ఎిజార:-
"काव्यमिदं विहितं मया वलभ्यां श्रीधरसेनरेन्द्रपालितायां।
कीर्तिर्तो भवतान्तृपस्य तस्य क्षेमकरः क्षितिपो यतः प्रजानां।"










 అభిషెల్రయు.

## గुంథ:-

















 \&లกిద゙-
"‘दीपतुल्यः प्रबंधोऽ्यं হब्द लक्षणचक्षुषां।
हस्तामर्ष इवांधानांभवेद् व्याकरणादृते।"










## భళ్టభభిలమున ‘రాఖుఱాజుగనిలయి":-










## గ్రంథ：－






## §．బ్ల్లాశ యూధ్యయూ：－














## ひ్ల్లాశ సొమొది：－


 Ш్దరు．

జస్మ దనాంఈ：ఇ山ర జన్మ దినాంも भ．2．กЕ9ం．

 బిరుదన్ను யలజేదిద్దురు．



## ひెల్లాశ శృఱొది：－










 ळొలిరుబ ఎిజయగ్తన్ను తిలిసుత్తరరె．

हलन्त्यम्：
उपदेशोषु अन्त्यं हल् तदित्संज्ञकमुच्यते ।
इत्संज्ञा यस्य वर्णस्य तस्य लोपः सदा भवेत् ॥
पाणिन्याद्युपदेरोषु इत्संज्ञाउस्ति प्रतिज्ञया।
ఎణణగళ ఎిజయయగఆన్ను ळึఆుఎాగ－
पाणिनीयशिक्षाइास्त्रे

त्रिषष्टि ६३ र्वा चतुष्टष्टि ६४ र्वर्णाः इाम्भुमते मताः।
स्वराः विंरातिरेकश्च २१ स्पर्शानां २५ पन्चविंशतिः॥
यादय२च स्मृता अष्टौ चत्वार२च यमाः स्मृताः।
अनुस्वारो विसर्गइच दुःस्पृष्टो हि प्लुतः क्वचित् ॥
సంతర स्पष्टीकरणम्－ఎండు ळొలి ఆ 山ుల ひెల్లాపద అథ్ఎన్ను




గద్యదల్లి చథామూధ్యయు:-
లుత్తరా ఎండుద నినాసియాద శ్రిల రాముహరణ క్రిలెఠ లాస్త్రిగళు గడ్య


 ేีళేగిసంతిజె.

ก. ब్లాశృతి ఎత్లరాజఱో.
๑. చౌముది చథా చలోలలలిని.

## ○. ప్యాచ్రితి ఎత్యరాజయో:-









ఈ) ఫృదంతనిదిఁఁ రాత్ర్ర

 గైఖిసిద్దారె. ఇడేอండు నుృతన ట్రయయอగగ.

## శ్రొముది చథా చలల్లలలిని:-





 పిధియెల అనుస゙రితదాగిది.






 ఓడుగిగిగ అనాయాసెలాగి ఆగిరుత్తడద.







 గ్రంథటస్ను రజిసద్దారె.



 యన్ను నిఱిద్దలరర.















 బళసేబळుదాగిడి.

## ఇతర ఫృతిగఆు:-






 ఈృతియన్ను రఙిసద్దాని. ఈ గ్రంథడల్లి ఱలణినియ ధాతఱలఠ Шన్ను ఎల్యుల్యానిసెలాగిడి.






 ఋుఖీలన బీอఁధిసెలు రఙఇసలారితు.

## డా. క్రిల రామహచర క్రిఱాఠ లాస్త్రలయచర ముత్తు 

## భూอమిచొ:-


 ఈృషయయిద












##  <br> © $\Phi$


















 నియుశ్తరాదేరు.

## త్రిల రాములరణత్రిఱుఠి లాస్తిగళ నిద్యాభ్యాసె:-










 బల山ంతదింద ळలగం లరరలరి యాతనిగతిగి ఒళగలదరు.


 థలడేదురు.









"(नन्नमेह) भ्रात्रे ममाद्यगुरवे श्री मुक्तादत्तविदुषे स्तात् ।"





 రాగుత్తిర్దురు.



"उकनीग्रामवास्तव्याः कौमुदीकृत्कुलोद्द्रवाः।
श्रीजयदेवशार्माण राजन्ते गुखो मम ॥"

"नमस्कृत्योकमीसद्रून् गुरूनथ वृषाकपी"







 'भारतावनत्युन्नतिबीजविमृष्टि:', 'आवइयकमन्यभाषासूक्ष्मज्ञानम्' 0 ల్లెe 2 నeయుखలడు


















 జుడేదురు.
 క్రిల గైळబా జి. 山ుळలరలజ రపర ఈణ్ణిగి బిడ్దురు సంతర అఎర "राधास्वामी









 నంతర తమ్ము మునేగి తిరతిదరు.

## 

గЕృతరల్లి తండేయుంతిద్ద అహర ఃరియి అణణనాడ 山ుం. బాల





"दासी" होते हुए रही जो घर् की रानी।
हमें छोडकर चली गई रह् गई कहानी ॥


"इस् समय इच्छा तो ऐसी होती है कि छाती पर पत्थर बांधकर यमुना में कूद् जाऊं और जलसमाधि ले लू, पर् तीन् छोटे-छोटे बच्चो का अबोध् मुंह देखकर, यह भी तो नही किया जाता ।"

 ఎండు అШరేల ఒండేడే బరేయుత్తారె. ఎంతే డుః2ిదల్లిద్దురు ఎంబుదేన్ను యృఃఃసีబముదాగిది.

 ఎం.ఎ. జరఁశ్ట్రయల్లి లుత్తిణణFరాదరు. అధ్లాయు 山ుత్తు అధ్యయనహన్ను


 ఆరంభిసిదరు. గకన2రల్లి లుత్తర2ండదల్లి ఎల్లాశడి ఃంది భాజయయల్లియిల


భాజేయ ద్య్య్యయయు అభాబ ఎడురాయితు. అదన్ను ఎునగండు క్రిల






 யృడియితు.







 శేళగినంతే మూఙిద్దారె.
"दीक्षितपदानुयाता व्याकरणक्षीरपूरिता वितता।
कल्लोलिनी सुललिता जैर्गाह्या रामशारणस्य।।"




 "बव्मसूत्रप्रमुखभाष्यपञ्चकसमीक्षणम्" ఎంబ ळేసరి గ్రంథఱలగి ก६२กరల్లి







 అభిముత.





"अतोगग्रे भवद्धिः सविश्रब्धि कार्य
वधानं ददद्भिः स्वसौविद्यसाध्यम् ।
विधेयं विधेयं भवेयं यथाऽहं
यथाकालमुक्तः कृतः कारितोर्थःः।"





"मान्दीतमोपनयना नयनाभिरामा
रामा रमारमणनाभिसरोजभूतेः।
भूतेर्गिरां वितरणे तरणे सहाया-
हायार्णवे च भवताद् भवतापनुत्तौ ॥"









 బరియులు థ్ర్రరంభిసిదరు.

అఎర గ్రెంథగళు ఈ శెళగినంతిఎె-
๑. सिद्धान्तादर्श।
9. सिद्धान्तकौमुदी "राजीवलोचनी" संस्कृत व्याख्या।।
2. सरलज्योतिर्विज्ञान।
§. मुक्तावली "बालबोधिनी" टीका।
भ. पत्रीकेषु प्रकट कविता तथा लेखा :।


## सिद्धान्तादर्श:















नमस्कृत्योकनीसदून् गुरूनथ वृषाकपी ।
कौमुदीविपिने छात्रान् व्याख्यामार्गं प्रदर्शये ॥ सूत्रादिविषये रब्दकण्टकिद्रममण्डिते । सूक्ष्मा यत्र हि पंक्तिर्हरयो यत्र रोरते ॥


 ముండుజరియల్లిల్ల. ఇడింండు డురుంతబెల స్రి.

सिद्धान्तकौमुदी ‘राजीवलोचनी’ संस्कृत व्याख्या :



 ఆదరె అదర తుద్ధ ळలగం అంతిముష్ర్రియు తయారాగలిల్ల.

## सरलज्योतिर्विज्ञान:

ఇదు கందిభాజేయల్లి రఒతతదాద ఒందు யబ్యరాబ్యఱాగిది. ఈ
 మిబెలజకనేయన్ను బూడలలాగిడి.



 Шుంతద భందస్సుగఆల్లి 山ునిలఁరంజపపాగి తిలిసదద్దారె.

## मुक्तावली ‘‘बालबोधिनि व्याख्या’’:


 ய్రెపటిసిదా.

## व्याकृति वत्सराजम्:





 గiองిసద్దారె. ఇడెอండు అய్లృఱఁ ట్రయయอగగ.
कौमुदी कथा कल्लोलिनी:







 గ్రంథపస్ను రఙసిద్దారె.



 యన్ను నిఱిద్దారె.



 ేేళగగినంతిది.

ค. सन्धिनिर्देरो प्रथमः कल्लोलः।
9. कारकनिर्देशो द्वितीयः कल्लोलः।
2. समासः स्त्रीप्रत्ययनिर्देशो तृतीयः कल्लोलः।

ङ. समास-तद्दितनिर्देशो चतुर्थः कल्लोलः।
๑. तद्दितद्विरुक्ति निर्देशे पञ्चमः कल्लोलः।

లుత్తరాధFచల్లి 6 చలాల్లలలగతితి. అవు-
○. गणनिर्देशो षष्ट: कल्लोलः।
9. प्रक्रियानिर्देरो सप्तमः कल्लोलः।
2. कण्ड्वादिनिर्देशो अष्टमः कल्लोलः।

ङ. पद वाच्य-लकारार्थनिर्देशो नवमः कल्लोलः।
भ. प्रकीर्णकनिर्देशो दरामः कल्लोलः।
. कृदन्तनिर्देशो एकादशः कल्लोलः।

 ळేలిదాద్దారే.
 సది, జసటెద, నగర, భళ











## అఱిఱెజ్ట్రణిగఆు:

०. संस्कृत् साहित्य का उध्भव् और् विकास्.

○. संस्कृत् साहित्य का उधभव् और् विकास्.

ค. రృఱుఎతార భూమిశి.


๑. Karnataka through the ages (p. 110).
2. モృతంత్రప్యల్రచపణ.
๑. पं. रामशारणशास्त्रिस्मृतिविरोषाङ्क:- गङ़नाथ झा केन्द्रीय संस्कृत् विद्यापीठ-अलहबाद-२ १९८५. पु. २.

## प्रथमोऽध्यायः

## జెకుథึอఁє ¢ధ్యాయి

# ద్యాకరరణ లంస్త్రదేత్ల సిద్ధ్రంతే కొఱొదియు న్థ్థన దుత్తు   




















 స్స్స్రృలభాషేయ బ్లెలి





 డల్లి $ి ల గ$ నిలడలాగిడి.
"कौमुदी-स्त्री कुमुदस्य इयं प्रकाइाकत्वात् "तस्येद"" (४.३.२३०,)
इत्यण् ततो ङीप्, ज्योत्स्ना- इत्यमरः. (१.३.२६) ${ }^{\curvearrowleft}$


 ఎండు దిలఖ్ఞణలగిది.

"शशिना सहयाति कौमुदी सह मेघेन तडित्प्रलीयते ।
प्रमदाः पतिवर्त्मणा इति प्रतिपन्नं हि विचेतनैरपि ॥"
 అడు ఔ శిళఈండంతిది.
"अकलकौमुदीज्चैव चक्रतुः सार्व्यकालिकीम्" (२३प) ${ }^{\wedge}$


 ఎల్లా బిఎరేగు ఃలగిబె.
"कु शब्देन मही ज्ञेया मुद हर्षे ततो द्वयम्।
धातुज़ैर्नियमैञ्चैव तेन सा कौमुदी स्मृता।" ${ }^{\circ}$





"त्त्वमस्य लोकस्य च नेत्रकौमुदी ।
कौमोदन्ते जनायस्यान्नानाभावैः परस्परम् ॥ ${ }^{2}$
हृष्टस्तुष्टः सुखापन्नास्ते न सा कौमुदी मता ॥"
"अश्विने पौर्णगास्यान्तु चरे ज्जागरणं निशिकौमुदी
सा समाख्याता कार्या लोकविभूतये"
"कौमोदन्ते जनायस्यां तेन सा कौमुदी मता"
सखीजनोद्दीक्षणकौमुदीमुखम्"०
कौमुदी दीपात् वातिथि:

कथा-(स्त्री) "चिन्तिपूजिकथिकुम्बिचर्चइच" (३-३-१०५) टाप् च. चథ०


 ఎందిది.


๑. "प्रबन्धेन कल्पना अथवा अबन्धस्य अभिधेयस्य कल्पना स्वयं रचना" इति सारसुन्दरी.
9. "प्रबन्धस्य कल्पनारचना, बङ्वनृतास्तोकसत्या" इति भरतः.
2. "प्रबन्धकल्पनां स्तोकसत्यां प्राज्ञाः कथां विदुः।

परस्पराश्रयाया स्यात् सा मताख्यायिका क्वचित् ॥ इति कोलाहलाचार्र्यः
§. नैयायिकमते हि नानावकतृकपूर्वपक्षसिद्धान्तवान् वाक्यसन्दर्भः।

## यया मनु:

> "यद्यद्रोचते विप्रेश्यस्तद्दद्यादमत्समरः।
> ब्रह्मद्याञ्च कथाः कुर्य्यात्पितृणामेतदी णितम्।

वार्ता । वाक्यम् । यथा रघु:" (८.४३)
"अभितप्तमयोऽपि माद्द्र्ं
भज्ते कैव कथा पूरीरिषु॥
विवरणम्, यथा रामायणे (१.८.६)
"सनत्कुमारो भगवान् पुरा कथितवान् कथाम्।
भविष्यं विदुषां मध्ये तव पुत्रसमुद्धवम् ॥"
 તひమలాగ్రులగి నిలణిద్దారె.

कल्लोलः-(पु), (कल्ल बाहुलकात् लेलच्)
ఇదరథ్ అలి. తేరె. ळష్టr. గ్రంథద భాగ.
कल्लोलिनी-(स्त्री)




यदा (कं जलं लोलं चपलं यस्मात् निपातितात् साधुः)
तत्पर्यायः उल्लोलः इत्यमरः (१.२०)
"कालिन्दीजलकल्लोलकोलाहलकुतूहली" इति उद्भटः।






 யృట్టి మాడుబळుదాగిది.













 $\omega^{\circ}$ రె.



## 







 గఆు బళసాద్దారె.






 సముగి డొలరేయుత్తడి.
 నాగుత్తననె. ఆ రాజను అబళ మొలల నిలరిరఔదాగ అฝళు "मोद

























 ఎందు బఆఃద్ద్దారె.


 ఈలిల్లలలిని" యి శృతిరురురు నిలఱద్దారె.

























 గుణ山ాగి పింగఔిసి శేలబరు గ్రంథగళస్ను రజిిదరు.









 గ్రంథఎన్న్న బరేదిద్దానే.

## 



 యున్ను யీడేద గ్రంథఎాగిది.





 $\omega^{\circ}$ రె.

## 



## ఇШర ఫృతిగఆు:-

○. उబ్దబ పెస్తుభ,
9. బ్లెయాచరణ సదద్ధాంత శొఋొదిల,

ఆ. బ్లెయృచరణ సిద్ధాంత ซృరిచర.

## Јబ్దు శౌశ్త్తుభ:-

ఇడు யలణినియ అఱ్ల్టధ్యాయిగి బరేద 山ృత్తి. అండరే ఇడు సంజ్లాణణ




 అల్లల్లి సిగుత్తడి.
> "तदेतत् सकलमभिसंधाय प्रक्रियाप्रकाशो गुरुचरणैरुक्त" $\cap$
> "इइ केचित् रोषावतंसानां श्रीकृष्णपण्डितानां चिरायार्चितयोः पादुकयोः प्रसादादासादित शब्दानुशासनः।॥"

## 














ก．జ్ఞ్గైంద్రసరస్ట్రత
－．భటేల్టజిదొొ్షిత్
2．నిలలచంఠ ๖ుజజ゙లOిల
ย．రృమూనండ
அ．రలముపృజ్ణఝభ్ట
๖．నాగึలత భష్ట
2．నాగొలత భష్ట

๒．రంగనంథ ఝ

త్ర్త్యీలఁధనిల
మ్రౌఢమునిలలరమూ
సుబబయలధధిన
త్త్ర DిCuళ
రత్న్న్రు \＆ొలశా

బృజひ్ట్దిలందు లెఁబర
బాలమునొలఁరమూ
ய్రొణికమో









○．లఘ゙ మునేలఁరయూ
－．उబ్దసెగగర
2．उబ్దరేలుణణ
§．సుధాంజస

## ๑．ய్రౌఢ్యునిలఁరఱూ：－



 గ్రంథగళ 2ండసె ఎిలెలజటాగిడి.

 బరేదిద్దాని.

## 2. జ్లియృళరణ సదద్ధాంతశారిశా:-

ఇడుం ఎ్యాచరణగ్రంథ. ఎ్యాచరణలాస్త్రెస్ను అదర దలశణనిచ తత్త్య





## సిద్ధాంతశౌయుదిల గ్రంథద యుळత్ట:





 బరేయలలగిది.














 ळొఆుత్తారె．అడు－
＂कौमुदी यदि कण्ठस्था वृथा भाष्ये परिश्रमः।
कौमुदी यद्य कण्ठस्था वृथा भाष्ये परिश्रमः ॥ कौमुदी यदि नायाति वृथा भाष्ये परिश्रमः।
कौमुदी यदि चायाति वृथा भाष्ये परिश्रमः॥＂


 ఈ గ్రంథ ఒษగగంంఱిదా ఎందథణ．






 భాజ్ సెరళదాగి గ్ర్య్యుఱాడుదాగిడి．

## సిద్ధాంతきొమొది గ్రంథద ఫిరుびరిひయ

## 







 జరయజయిసెత్తారె.

## జరిభౌఱ్ ఝ్రేచణ:-

 సైచ్తృలఒ అంహळాడుడరిండ "अनियमे नियमकारिणी परिभाषा" ఎండు ఎల్లి






 ఎండుజ్రుద్ను






## चంధి జ్రేచరణ:-



 లుదాळరణిగఆ మొอలళ తిఅిసిద్దారె.

## అఱ్యయిఝ్ట్రచణణ:-

सदृशां त्रिषु लिङेषे सर्वासु च विभक्तिषु।
वचनेषु च सर्वेषु यन्नव्येति तदव्ययम् ॥




## స్త్రలజ్రేశరణ：－

 బరదాల யఃయయ 山ూలలదిండ లుదాळరణొగి＂गोपस्य स्त्री＂गोपी，అజాది







## పమూపむ్రీపరణ：－







## తద్ధిత్ర్రేరణ：－

 గึอంఱిబె．

లుదాळరణ刃ก＂दरारथस्य अपत्यं पुमान्＂दाशारथी，पाणिनिना रचितं पाणिनीयं，



## ఆిఙంతష్ర్రచరణ：－







## 


 ితిలిద్దిరె．

## ヘబణరదిష్త్రరణ：－




धातुसूत्रगणोणादि लिङ्गनुशासनम्।
आगमप्रत्ययादेशाः उपदेशा प्रकीर्तिताः ॥
 ితిిలిద్దారె．

## ద్ృిదశశ్స్రరష్త్రేశణ：－











## లింగలనులరేస్త్రేరణ：－

ซబ్దగళల్లి యృ山ు లబ్ద యృ山 లింగ ఎంబు山 స్తృలలింగ，山్లల్లింగ




 దలగిది.








 ซృరణణాలగిడి.

 ఒండు ఃరు జురひయ ఈ శిళగినంతిడె.


 గ్రంథగఆస్ను రజిసద్దారె.

 ఎస్ను రజసిదద్దారె.

 ఎంబిరేడు గ్రంథగళస్ను బరేదిద్దారె.






 సిద్ధరంతశృ山ుది" యు ఆశరగ్రంథటలగిది.

## ేథాజ్సరతల్సగగర:-








 ఎిఱారగళల్లిన కిరుళన్ను సులభఱాగి ळలగం 山ునింలరంజనాత్ణచపలగ







 ఎలగిది.

## 


 ఇదర భాష్ష లలితణాగిదే. అకియోద అలంశారగఱాగలిఁ, చపిసెముయ



 అధ్యలయగళ ळలగి లంబచగళల్లి ప్ణ ఎిభాగగఆు. ఆదరర తరంగగగళు











 ఎుధ్యచరలడల్లి.

 శిళగిస 山్యద్యదంద తితిదుబరుత్తడి.

> "प्रवितततरङभभङ्गिः कथासरित्सागरो विरचितोऽ्यम् ।
> सोमेनामलमतिना हृदयानंदाय भवतु सतां ॥"ः
















 యைగిదా్దాని.





























ఈథాటిఁఠదల్లి బరు山 ఈథేయ లుగముడ బగగగిన ఈథేయున్ను ఎిన్తుర



## 





ఈ ముळాశథియు ము2్యిఎాగి ఎత్లరలజనాద లుదయనన ఈథాయాగి













ఇదరల్లిషె. ఇదర ఈథేగళు జగత్తిన ఈథేగళిగెల్ల మూదరియాగ ష్లెలరచపాగి





"जलाहतौ विरोषेण वैद्युताग्नेरिव द्युतिः।
आपदि रफुरति प्रज्ञायस्य धीरः स ऐव हि ॥"


> "भद्रकृत् प्राप्तुयात् भद्रम्
> अभद्रं चाप्यभद्रकृत्।
> कन्दुको भित्तिनिक्षिप्त
> इव प्रतिफलन्मुहुः ॥" ${ }^{2}$







## 










 ేథాసెరతల్లాగరడల్లి అజ్జ, అజ్జి, గురు ఃoరయయరు, రాజరు, రాణి, 山ుంత్రి, ఆళు,





















 ఈథึయొ.





జగళ శదనగతిల్ల，ఒందిల 山ునియల్లి ఎరశశరశు 山ుతగళన్ను అ山లంబిసి




## ేథాస్సిత్లుగేరద భాష్షంంతరగళు：－






 యాదుదు．












 ＇سులనిరుగ్నిమిత్ర＇గళన్ను గద్యదల్లియబ，భతృశळరయ ఎరడు శత్గళాన్ను




 భాఖలంతరపృ ఒందు．

 జేంజరా ఇబరుగళు మూఙిరు山 ఇంగ్లిజ్ భాఖంంతరద 山ులలచ జగద్టిలాల












○．క్రిల ఎび．చి．నాగరాజరాలా
－．డి．ఎసో．ఆరా．లిలలర
2．డా．๙ి．దొలృః
§．క్రిల రీలఱ్జేల తముఁ
भ．డా．రాముభటో



巨．ய్ల్ల．బిఎనా．సుమిత్రలాయి








 జుడేదిది.















## 






 స్బంధిసిద గ్రంథటెండు, సిద్ధాంతశౌ山ొదియయంతె అథషల సిద్ధాంత





 నలణిద్దారె.



## ఈథా జదద ఔఒత్య ఈ శ్ళళండంతిది:-







 క్రిயఠఠగళు బహస్ద్దారె.


 ఱృణినియ బృత్తాంతగళు ఈ ఈథాసరతాగ్లారదల్లియిల బరుత్తతి.


 నఱుగి డిలరేయుత్తది.
 నాగుత్తనని. ఆ రాజను అఎళ మెలల నిలరేరఙఃదాగ అ山ళు
"मोदकैस्ताडय" ఎన్నుత్తృహ. అదర నిజఱాద అథఁ "मा+उदकै:+ताडय= నిలరినం మీఎడేయబీఁడ" ఎందథ్ ఆదరా రాజను అదన్ను "मोदकैस्ताडय" ఎండరర "もడుబుగఆిండ ळోっడ"" ఎండు అథ్



 యల్లిల ఎ్యాశరణజన్ను రాజనిగి ఈలిసి అజనస్ను ఎ్యాశరణజా్ణి





 గఆాల్లా స్స్స్పృల ల్యాచరణలాస్త్రే దిగ్గజరడ్దు.










 ఎండు బఆసిద్దారె.


 ఈలల్లలలిని" యి శృతిరురురు నిలెద్దారె.





ळొగగ జిక్ర్,



 ద్దారె.


 అబాలబృద్ధరగగం ట్రియఱాడుదెల ఆగిది. అదన్ను అరత రాముహరణరు

 ఈథా చలాల్లలలిని" గ్రంథద ములలఈ స్లలభఱాగి నిలఱద్దారె.









## 



 తతిసలాగుఱుదు.

## అఱిటెజ్ట్రణిగఆు:

๑. राब्दकल्पदृमः. सुन्दरलाल् जैन्, मोहिलाल् बनारसीदास् १६९१.
๑. कुमारसंभवम्.

9. ఐరひేస్టత్రుయ

๑. वाचस्पत्यम्.
9. पाणिनीय अष्टध्यायी-मं. मं. पण्डितराज डां श्रीगोपालशास्त्री. पु. ३१.


๑. లఘ゙ సిద్ధాంత చౌఋొది.

2. సిద్ధాంత శౌషొదిల జండ్రహం.
§. అధిగШు ซౌఋొది.

 భాష్రంతర.

# प्रथमोगध्यायः <br> డంంజెఱొలesధ్యాయి <br> <br>  <br> <br>  రలిల్లలలగఆళ సేమిలశ్ట్లె్ముక అధ్యయయన 

 రలిల్లలలగఆళ సేమిలశ్ట్లె్ముక అధ్యయయన}


#### Abstract

                  


## చథాసరితాగ్సగరద శమున్ట్యయతి:-


 ముంగఆాజరణేయన్ను గ్రంథద ఆదియల్లి ఈ రొత ఱూఱిద్దానె.
"इदं गुरुगिरीन्द्रजाप्रणयमंदरांदोलनात्।
पुरा किल कथामृतं हरमुखाम्बुधेरुद्रत् ॥
प्रहस्य रसयंति ये विगतविघ्नलब्धर्धायो।
धुरं दधति वैबुधीं भुवि भवप्रसादेन ते ॥" $॰$









 గiอళ్ళుత్తే
"धुरं दधति वैबुधीं भुवि भवप्रसादेन ते॥"




 ఋొండుజరేసుత్త ఈ రఁత మొఱద్దారే.
> "नत्वा गुरून् गणेशादीन् कल्लोलिन्यां मुदे विदाम्।
> व्याकृत्यब्धिसुसद्ननसज्चयोग्र विधीयते ॥"



 జూడలాగిడి.






 తిళిసద్దాని. ఆ లెల్లలచపు ఈ శిళచండంతిది.

> "औचित्यन्वयरकाहा च यथाइाक्ति विधीयते।

कथारसाविघातेन काव्यांशास्य च योजना॥" ${ }^{\circ}$






"एकान्तसुखिनो देवा मनुष्या नित्यदु:खिताः"?
డెలపతేగళు యాషాగలల సులిగళు, 山ునుజ్యరు యామాగలల

















 ఎండు யృబఁఁియు అభయబనన్నిత్తఆు.
 గతియన్ను కిబనల్లి ఎిబారిసెలు కిబను "శృలాంబియింబ 山ుळలనగరియల్లి


 ఋుచ్తాయగింఆిసద్దానే.

 ळేపినిం బ్యూతనాగిద్ద ఎంబ ఎూఃియయు సఱుగి ఇదరిందలాల

 సఱుగి తితిసుత్తలా.




 ఇల్లి ఎరుజుజయయ టృత్తంత ఎండు ळేసెరి చథెయున్ను ఆరంభిసిద్దానే.
 ఎరరుひయ బగ్గె కిలిడుబరువుదిల్ల.









 చరేడిలయ్దిరు.





 ితిసిద్దానే.





யెటలిలயుత్ర ఎంబ ळేసేరు ळొగగ బందితు ఎంబుదన్న్ ేథాయు























 బగ్గగ బూ\&ంిగళన్ను ఒదగిసుబుదిల్ల.












 దిండ తత్టిలదను.







## 



 రలముచరణరు ఐఁకులుదిల్ల.

'ननाम्ना वररुचिश्चायं तत्तदस्मै हि रोचते।
यद्यद्वरं भवेत् तत्तदस्मै हि रोचते ॥॰०

 ఎంబ ముઠింి చథయయల్లిదె అదన్ను రలయులరరణరు ఐల్ుల్రుదిల్ల.





'،आश्रर्यमपरित्याज्यो दृष्टनष्टापदामपि ।
अविवेकान्धबुद्धिनां स्वानुभावो दुरात्मनाम् ॥»॰




"किन्तु दृष्टनष्टापदोऽपि दुष्टः स्वभावं न परित्यजन्ति",
 బిడుఱుదిల ఇల్ల.


"अदत्तां गुरुभिः स्वेच्छमुपकोशां कथं भजे।
वरं हि मृत्युर्नाकीर्तिस्तत्सखीहृदयं तव ॥"०


"वरं पत्यौ प्रवासस्थे मरणं कुलयोषितः।
त तु रूपारमल्लोकलोचनापातपात्रता॥"



## అదన్నిల రాముహరణరు:-

"प्रवासस्थे भर्तरि कुलीनयोषितो मरणं श्रेयो
न पुना रूपैकपक्षपातिलोकलोचनापातपात्रतेतिः॰


 నిలరస్ను నిలడుక్తిరలు హత్రులిన అళివిగలగి తానేల అదస్ను ిిన్నుతర ఇరుఱ
 ळొల్రుత్తాని.
"पाणेभ्योऽपि हि धीराणां प्रिया शातृप्रतिक्रिया"
"वृत्तिः कष्टं कृरा जिगीषवः"
"अबुद्ध्वा चित्तमप्राप्य विसंभं प्रभविष्णुषु।
न स्वेच्चं व्यवहर्तव्यमात्मनो भूतिमिच्चता ॥"






 ळరణెగళు ఈ రొతియల్లిబె.

 யึอడలిก

○. అび $్$ ㄱధి

2. ळల్లంధ

भ. గ్లైద్సైధ







 युद्धाटितम्"
 पदोषः"



 णात्ये"
 मेण"








 దాळరణాగభు ఈ శేళగనంంతిటె.







 ジద.
山己ద．








 विषयुक्तांश्चेत्यर्थः；＂तथायुक्तं चानीप्सितम्＂इति कर्मत्वम्।
＂सक्रूना पयस्पाशास्य＂ఎంబ 山己దడ బగ్గె ఈ రొత ఎిజరిసిద్దారె．
＂पाइाकल्पेति सः कुत्सितस्य पयसः इति भावः＂ఎండు ఎిळరపळలగ ితిసదద్దారె．
 निर्देशात्मक द्वितीयः कल्लोलः＂ఎంబ ఎరడనసయ అధ్యలయయదల్లి ซౌరచగఆ

 జృత్తాంతఐు ఎణిణ తగగొంంఱిది．

```
ఎరరుజిగగ రాళ్టజNసు మిల్ర.నాదు ఈథ
ఆదిత్ర\mp@code{\omegaుFN ఈథ}
అळంచురి బు&%య చథథ
```




```
దెలమిలశృతి ఎంబ లుద్యానదద ఈథ
```



```
రిబి 山ుळలరాజన ఈథ
```




 पञ्चाङ़लिहस्तम्" లుదలळరణయయస్ను నిలఱద్దారె.

2. "अनुर्लक्षणे", "कर्मप्रवचनीययुक्ते द्वितीया" ఎ०బ तंगेड्ज़्रें "अनुप्रासा दवात्तायनम्" లుదాळరణొయస్ను నిలఱిద్దారె.
"अधिरीङ्स्सासां कर्म" "कर्मण्यण्"' "अतः कृकमिकंसं इति सः"
 ిితిస నంతర ఋొండు山రేయుతార్తరె.
 ఈంఙంంిది.
 ड्रे. రౌముహరణరు "गंगाराब्दात्स्वार्थेकनि "केड्ण" इति ह्रस्वानन्तम् अभाषितपुंस्काज्चति साहचर्येण आदाचार्याणाम्-इत्यात्वम्"।

 हलस्तद्धितस्येति यलोपः"।

 ळొలిద్దారె.






 ఎాగుత్తడి.

ततः कदाचिदध्यास्त वसंतसमयोत्सवे।
देवीकृतं तदुद्यानं स राजा सातवाहनः॥
विहरन् सुचिरं तत्र महेन्द्र इव नन्दने।
वापीजलेऽवतीर्णोभूत् क्रीडितुं कामिनीसखः ॥
सा जलैरभिषिंचंतं राजानमसहा सती।
अब्रवीन्मोदकैर्देव परिताडय मामिति ॥
तच्छुत्वा मोदकान् राजा दुर्तमानाययद् बहून्।
ततो विहस्य सा राज़ी पुनरेवमभाषत ॥
राजन्नवसरः कोत्र मोदकानां जलान्तरे।
उदकै: सिक्च मा त्वं मामित्युक्तं हि मया तव॥
सन्धिमात्रं न जानासि माशब्दोदकराब्दयो।
न च प्रकरणं वेत्सि मूर्खस्त्वं कथमीदृशः॥
इत्युक्तः स तया राजा इब्दशास्रविदा नृपः।
परिवारे हसत्यंतरर्लज्जाक्रान्तो झगित्यभूत् ॥
 ळొఆు తల్తరె.
"सातवाहन एकदा वसन्तोत्सव समये नन्दनेऽमरपतिरिवनिजारामे रामा दीव्यन् गाहमानजनतापहारिणि वापिणि रमणीये जलक्रीडां कर्तुं तत्रत्यवापीमवतीर्णः तत्र व्यात्युक्षिकायामत्यायताक्षीणां करवारिभिरभितः सिंज्चस्तदभिषिक्तिमसहमानया शिरीष सुकुमाराङ्गया स्वकीयान्यतममहिष्योक्तः ‘देव, मोदकैर्मां ताडयेति’। तदाकर्ण्य प्रिया मे मोदकैस्ताड्यमानामात्मानमिच्छतीति बुद्ध्या नृपतिर्द्रुतं वचनकरेण बहुमोदकानानाययत्। तानालोक्य विहस्य साऽभाषत-राजन्नत्र जलान्तरो कोऽवसरो मेदकानाम्? उदकैर्मां मा सिञ्च इत्येवमुक्तस्त्वं माइब्दोदकराब्दयोः सन्धि प्रकरणन्च नावगच्छसीत्येतावान् मूर्खः। परजनमेजयोऽपि शब्दशास्त्रविदा तथैवं पराजितो राजा सत्रीडः परित्यक्तजलक्रीड:, जातावमानः, परित्यक्तकार्यान्तरावधानस्तत्क्षणं निजवासमविशत्।

 ఱృలగదచగఆన్ను తరిసదను అదన్ను చండు రాజ 山ూ లుదశ్ృృః ఎంబేరేడు










 पाण्डित्यं विना ह्येषा लक्ष्मीर्न प्रतिभासते। विभवैः किं नु मूर्खस्य काष्टस्याभरणैरिव $\|^{\wedge}$


 ఒడేయనిండు గెరి ఐొలిద్దారె.

 ిఆిసద్దార్రె.

## "ज्ञायते सर्वविद्यानां मुखं व्याकरणम्"’




 ఎనాడ అభిమున్యులిన మురిముగనాడ తతానిలశనంబ రాజను శాలాంబి







నాల్మనేయు తరంగదల్లి బరుఱ:-

 ఈృబిడలలుగి.



 ఱూఐిద్దారె.

స०ङठ "समास-स्त्रीप्रत्ययनिर्देशात्मक तृतीयः कल्लोलः" ळే $\vec{N} 0$ त



2. సेద్ధేరరయ もథ.






 ळีణయయల్టట్టిడి.








 ఎత్లరాజ 山ుత్తు ఎలసే山డుత్తేయర చథథ.

○. "अव्ययंविभक्तिसमीपसमृद्धिव्यृद्ध्यर्था भावात्ययासंप्रतिशाब्दप्रादुर्भा वपश्चाद्यथा

 யెట్టియన్నిల నిలడుత్తరరి.




 ఎంబ జెదగఆఆన్ను లిలైజఱలగి జీอఁఱిసద్దారె.


‘सामी’ इति समासः (सामीत्येतदव्ययमर्धशब्दपर्यायः) ఎ०బ సँఎอड्త ఱుత్తు
 யుదజన్ను నిలఱిద్దారె.
 యూกి＂कल्पनातीतेन＂ఎంబ 山己దむస్ను నeఱిద్దారె．







 ిిలిస్సత్తారి．

 वैकल्पिदह्त्वः ఎండు తిఅిస్సత్తరరా．





 ేేళగగినంతిది．

9．${ }_{\mathrm{T}}^{\mathrm{c}}$ ల


## 








 ( $ి$ ర)
๑. शिव: -
2. शर्वा-
§. इमशानप्रियः -
भ. उमाधवः _
厄. राङ्कर:-
2. शाम्भुः -

厄. राशिरोखरः।
६. शाशिमौलिः।

ค०. विश्वेशः।
กด. धूर्जटी।
๑๑. वृषध्वजम्।

○2. ईश्वरः।
ก®. विश्वेशः, कपर्दी,

๑. भवानी -
๑. जगज्जननी-
2. हेरम्बस्याम्बा -
e. शर्वाणी -

भ．दाक्षायिणी－
．शिवा－
2．पार्वती－
e．गौरी－
๒．शाम्भवी।
ค०．गिरीन्द्रजा।
ค०．गिरिजा।
○．．राक्ती।
Q2．कात्यायिनी।
๑ఆ．काली।
กタ．चण्डी।
กe．पर्वतनन्दिनी।

ค．मध्वरी।
9．विष्णुः।
బ్రథ్లదాひే むదగఆు：－
๑．ब्रह्म।
－．धात्रंशःः
2．पितामहः।
ङ．विरिक्चि।

## 

๑．कुमारस्वामी।
－．कार्तिकेयः।
2．कुमारः।
§. षाण्मातुरः।
भ). स्कन्दस्वामि।

๑. अमात्यः।
๑. सचिवः।
2. मन्त्रिः।

कसरी, सिंह:, व्याघ्र:,
हस्तिनी. करिणी, द्वैपः, गजः,
राबरः, लुब्दकः, (बेड)
मालवदेशः, मथुरा, मधुरे, उज्जयिनी, कौराम्बी, कटाहद्वीपः,
डोंब( दोंब)
दाशः,

०. पुरन्ध्री - पुत्रवती स्त्री।
๑. सूत्या - नव युवती।
2. भुजिष्या - चेटी।
§. वृषाकपायी- लक्ष्मी पार्वती च।
श. अग्नायी - अग्ने: स्त्री।
e. वृषली - वृषलस्य पत्नी।
2. गोपी - गोपस्य स्त्री।
e. अश्वपालिका-।

छ. वामोरूः - सुन्दरी।
๑०. अवामोरुभार्या - सरलस्वभावरील् नारी।
१०. अनासिका - न नासिका यस्याः सा।
๑๑. सुपदी - सुन्दरौ पादौ यस्याः सा।

Q2．सदाक्षी－चतुरा।
ก®．घटोध्री－घटसमान् नयनौ यस्याः सा।
Оタ．अनड् वाही－गौः।
०．．राजमहिषी－राजस्य प्रमुख पत्नी।
०2．प्रजा－
De．अजा－


ค．श्राणा－Dిలరు
－．संयाव－ळల्ల
2．पेटक－戸ंలて

भ．कुण्डलिनी－జ®२బి
๖．फाण्ट－ळలిన్ను ఒడేడు అదరింద మూడ్ల్టట్ట సః 2రద్య
2．रसगोलक－ठ币तᅦల్ల



## （9）ఈరిద తిఱณగళు：－


๑．पूडी－யुणठ

ध．ईण्डरिका－
भ．अपूप－
ᄅ．पर्पटः－ळ．

## 


9．रामठजीरकादिविविधाभिधार्यप्राज्याज्यसुगन्धितद्रव्याभिधारित सहरिद्रशतापुष्पै
－लाकुस्तुंम्बुरुमरिचलवङ्गतुवरिकामाषमूल्यमुस्तकचणकसतीनकसूपै：－



 ซరళుగలిండు తయారిసద సారు అథలా గుజ్జు．
2．उग्रगन्धाराजकर्णिकासोपस्करवेल्लपटोल महाफलासप्तलापालकवास्तुककोशात कीमूलिकाकर्का रूबिम्बिकावृत्ताकालुप्रभृत्यनेकशाकै－అజळాయిన凶त्ను，


 గษింద తంయారిసిద，భశ్ష్యలగకు．
§．स्वादिष्ठाभिस्साकरप कादधिबटकादिविविधवर्णनातीतषड्रसव्यञ्जनै：－श्ల్టిది，






○．नैषध्यानाम्－నిజ్రరాజ్య
9．आवान्त्यानाम्－అखంతిలठठజ్య
2．पाण्ड्यानाम्－ШОడ్యరరజ్య
§．पौराणाम्－யఎఎఎ૬ రठజ్య
भ．पाञ्चालानाम्－Ш०ひఔలదిల厄
．कन्यातश्चायातानाम्－चत्रेचుబ్జుదేల

2．मागधानाम्－山ుగఢరठజయ
๒．वाङानाम्－凶०ताठठజ్య

○．भेरी－そ९०
9．झर्झर－
2．मृदङ－Ш్లుШంగ
巴．पणव－
भ．वेणु－कृङలు




प्रातिभेन ब्रह्मसूत्रेण，उपनिशादा च गोष्घा，गीतया च गीत्या，सुवर्णमयेनालंकारेण， प्रकृष्टेन छन्दानुरोधेन，प्रसादकेनगुणेन，आन्वीक्षिकीभिः，प्रस्थानत्रयीभिः，साहित्यविग्रहि




 నడేదపు．

బణ్ణగళ ఎిజయయదలల్ల రాముహరణరు ఇదేల రఁత అనేలも బణ్ణగళ ळేసేరుగళస్న్నం ळొతిద్దారె．

๑．शोणी－शोणात्प्राचाम् सूत्रेण स्त्रीत्वम्।
9．रोहिणी — वर्णादनुदात्तात्तोपधात्तोः नः।（（\％०Ш⿱屮凵口））
2．नीला－（నిలे）
ङ．कल्माषी



 ¡రతత్లాగరదల్లిల్ల.



 జ్యుః బరదळలగి బఆసద్దారె.




०. गिरीन्द्रजाजानिः - गिरीन्द्रजा पत्नी यस्य सः- शङ्सएः।
๑. अनुनाथितवती - प्रार्थयतीति।
2. अत्यारूढ्या - अत्यन्त् धृष्टता।
๕. अनभ्यर्हित - अपूजनीय।

भ. वरिवस्यापरः - आराधकः।
㔾. विद्याभिग्हन _ विद्योपार्जने अत्यन्त लालायितह्।
2. देवद्नयड - देवानां आराधकः।
8. अवालुलोकयिषु:-
๒. यात्रा - देवरानी (यातृ शब्दस्य तृतीया)।

ค). कत्र्यः - त्रयः कुपुरुषाः।
OO. बाहुबाहवि-
๑๑. वासतेय्याः - रजनी।

Q2. चन्द्रार्धं दत्त्वा-।
०ङ. प्रत्यजानात - प्रतीक्षा।

〇ク．उद्न：－जलः।
○ह．अनेनाः－निरपराधः।
๑2．दूनेन－दुःखि।
๑e．मित्रध्रुट्त्वमुदजीघटम्－सुह्ठुद् द्रोहोध्यातनं कृतः।
๑巨．अतीमकम्－
9०．अनेहसमनैषम्－कृत कालक्षेप：।
๑ด．अपाकृततन्नैयूनि：－
9．．चिरण्टी－स्त्री।
१2．उपेनानन्या：－
๑९．वातरूण：－
9९，अन्वेनं मर्त्या：－
9ह．रोषायुष्क：－
92．व्यात्युक्षिकायाम्－
๑ए．लून पक्षजीनपक्षीव－
Э६．व्यानीयत－
2०．आक्रन्दिकीभूय－
2०．साप्तिकः－अश्वारोही।
2ง．हस्तेकृत्य－विवाहित्।
22．अन्तःसत्त्वा－गर्भवती।
2९．गृहाणेममसिमस्यसेरस्य－（गृहाण＋इमम्＋असिम्＋असि＋असेः＋अस्य）।
29．अनवाप्तेर्म：－
2．विशारदिम्ना－कुरालः।
22．आसुरायणी－असुरकन्या।
2ल．मितङ्गः：गजः।
2छ．तुराषाट्－इन्द्रः।
४०. उपवीणयन्-।

ยก. आर्जवाद्धद्धाः - नम्रता सह वरीकृतः।
४๑. आहव-संग्रामः।

ఆ2. स्वप्राणानां सत्पणनम्-
४४. असयन्-

ङभ. पतिष्कराम्-
©ह. खलतिः-
ङ2. तुन्दिभः-
ఆల. चुल्लः-
ச巨. प्राध्वंकृत्य-
भO. सदू़्-
भ๑. एखितुमनाः - इख गतौ- गन्तुमनाः-
भ9. असुकः-
श2. पारिपन्थिक-स्तेयः।
भ४. अनुपदिकः-
ЯЯ. मनुजपरिवृढः - मनुष्याणां राजा।
OB. प्रबोधितचरी -
33. निश्चप्रचम् -

भe. सादिनः - अश्वारोही।





 तेनात्र तद्योगे षष्ठी ओदनस्यपाचक इतिवत्। भविष्यति गम्यादय इत्यधिकारे

विहितस्य तुमुन्गवुलाविति णवुलो योगे तु अकेनोर्भविष्यदाधमर्ण्ययोरिति षष्ठीनिषेधः


 पञ्चषाणां वर्षाणां भूत इति ‘तमधीष्टोभृतोभूतोभावीति’ प्रकरणे ‘ वर्षाल्लुक् चेति’ विहितस्य खस्य ठ्जो वा ‘चित्तवति नित्यम्’ इति लुक्" ఎండు ॠఎి స్తరరఏాగి ితిస్సత్తారె.
 "सुदिनं पुण्यञ्च तदेवाहः इति विग्रहे प्रशास्तवाचकसुदिनइाब्देन कर्मधारये ‘राजाहः सखिभ्यष्टच्, ‘अहोग्ह एतेभ्य’ इति प्राप्ते ‘उत्तमैकाभ्याज्चेति निषेधे ‘अह्ठष्टखोरेवे"ति नियमेन ‘नस्तद्धिते’ इति टिलोपे ‘रात्राह्नाहाः पुंसी’ ति बाधित्वा



 ితిసిద్దారె.

"सदा सर्वदा गतिसम्मुखीभिः अथवा सदागतेर्वायोः सम्मुखीभिः, सती आगतिः सदागतिस्तत्सम्मुखीभिर्वा, सती ‘समीचीना या आसमन्ताद्रतिस्तत्सम्मुखीभिर्वेति विग्रहः, अपरेषां पतीनाम् रक्षकाणाम् अपरासां पतीनां वा पराङ् मुखीभिः (दिक् पूर्वपदान्डीप)।


"गणणावतारो जातोऽयं गुणाढ्यओ नाम"। ${ }^{\circ}$
గణద అఎతలరఱాగి ఈ గుణలఢ్యను జనిసిద్దానె. గుణగఆ అగరపెల



"दत्ता मे वासवेनैषा तुष्टेनेति स भूपतिः। नाम्ना वासवदत्तां तां तनयामाकरोत्तदा ॥จ

ఇండ్రుు సంతుజ్ట్రనగి నిలిద ఎరదింద జనిసిదఱల్ద్దింద ముగఆిగ

 శేళもంశంతిది.
"प्रियादन्तोच्छित्तात् पुष्पात् संज्ञां न ज्ञातवान् यतः।
अतः स पुष्पदन्ताख्यः सम्पन्नो गणसंसदि ॥थ

 నాదను.



๑. "नहि मोहयति प्राज्ञं लक्ष्मीर्मरुमरीचिका" $\bigcirc$
 ఱెలొळఎన్ను ఐుట్తిసలారళు."
9. "अकाण्डपातोपनता कं न लक्ष्मीर्विमोहयेत्",
 గiองిస్పచ్రుల్ల?."
2. "ईई्ष्या हि विवेकपरिपन्थिनी",2

४. "शीलं हि विदुषां धनम्"

भ. "प्रियबन्धुविनाइोत्थः इोकाग्निः कं न तापयेत्" असंसारं जगत्यस्मिन्नेका नित्या ह्यनित्यताः $\cap$
 తాని సుఙడు?"

〕. "ज्ञानमार्गे ह्वहंकारः परिघो दुरतिक्रमः।
ज्ञानं विना च नास्त्येव मोक्षो व्रतशतैरपि ॥
स्वर्गस्तु न मुमुक्षूणां क्षयी चित्तं विलोभयेत्" ${ }^{2}$


 బలరడు.
"अक्लेशालभ्या हि भवंत्युत्तमार्था महत्मनाम्। जन्मांतरार्जिताःस्फारसम्स्काराक्षिप्तसिद्धयः॥"2

 ఘలమాగి సిద్ధిగళు అఎరిగి తాబాగి బండు ఒదగుత్తఱి.

## అఱిటెజ్ట్రణిగఆు:


०. कौमुदी कथा कल्लोलिनी, रामशारण शास्त्री. चौखम्बा विद्याभवन वाराणसी.
๑. कथासरित्सागर:.

๑. कथासरित्सागरः त. २, इलो.७०. पु. २६.

○. कथासरित्सागरः ३, इलो. ३७. पु. ३४.
๑. कथासरित्सागरः त. ३, इलो. ४४. पु. ३५.
०. कौमुदी कथा कल्लोलिनी, पु. १०.
๑. कथासरित्सागरः त. ४, इलो.४१. पु. ४८.
०. कौमुदी कथा कल्लोलिनी, पु. १०.
๑. कथासरित्सागरः त. ४, इलो. २२७. पु. ६०.
2. कथासरित्सागरः त. ४, इलो. २२७. पु. ६०.

ค. ఈథాసిత్ల్సార 山్ల.













# प्रथमोडध्याय: <br> ఆరెనిల అధ్యాయి <br> <br> శలయుదిల కీథలకయిల్లలఅనియు లుత్తెరరధీ ఆరు <br> <br> శలయుదిల కీథలకయిల్లలఅనియు లుత్తెరరధీ ఆరు శ్ల్లలలగెళ సమిలకల్డత్ము అధ్యయయనె 

 శ్ల్లలలగెళ సమిలకల్డత్ము అధ్యయయనె}

 గళ శమున్టయయతయయున్ను త్రిల రాముహరణక్రిషాఠిలాస్త్రగగక మాఙిద్దారె ఎంబు






 గษిబి. అవ్ర-
๑. गणनिर्देरो षष्ठः कल्लोलः
9. प्रक्रियानिर्देशे सप्तमः कल्लोलः
2. कण्ड्वादिनिर्देरो अष्टमः कल्लोलः

ङ. पद वाच्य-लकारार्थनिर्देरो नवमः कल्लोलः
भ. प्रकीर्णकनिर्देशो दशामः कल्लोलः
ᄅ. कृदन्तनिर्देशो एकादशः कल्लोलः


 రా山ుహరణరు ఒండు లెల్లలzపస్ను నిలిద్దారె.
＂नमाम्यरोषविघ्नौघगारणं वारणाननम्।
कारणं चर्द्धिसिद्धीनां दुरितार्णवपारणम् ॥＂
 గణెలతనస్ను నమిసుత్తా ఎుంగళడ అబత్య్రతేయన్ను మునగండు రాములరణరు

 ఎుంగఆ山న్ను ఆజరిసద్దారె．
＊नमामि ఎत్నుШల్లి ‘नम्’ ఎत్నుШ ‘भ्वादिगणधातुः’।
＊अरोष ఎत్ను凶ల్లి ‘रीष्＂ఎत्ను凶 ‘रुधादिगणधातुः＂।
－विघ्न 凶న్నుШల్లి ‘विपूर्वक’，‘अदादादिकात् ‘हन्’，＇धातोः कप्रत्ययः’।
＊ओघ ఎत्నుШల్లి ‘उच् समवाये इति दैवादिकाद् ‘घजि’ फ०తులిतొ पूषोदरादित्वाञ्चकारस्य घकारः।
＊गारणा ఎన్నుШల్లి＂गॄ＂ఎన్ను凶＂तौदादि＂ఆద్దరంద ధాతువిति णिजन्ताल्ल्युट् प्रत्ययः।
＊वारणाम् ఎत్నుШల్లి＂वृ＂ఎत్నుШ＂क्रैयादि＂ఆద్దठండ ధాతులిగె णिजन्ताल्ल्युट् प्रत्ययः।
＊कारणाम् 凶त్నుШల్లి तानादिक ‘कृ’ ధాङుฝిती णिजन्ताल्ल्युट् प्रत्ययः।
＊ऋद्धि ఎన్నుळల్లి सौवादिकाद् ‘ऋध्’ ధా తులిగत क्तिन् प्रत्ययः।

＊दुरित ఎ०బల్లे दुरुपसृष्टत् आदादिकात् ‘इण् फ़ङుबిते क्तान्तः प्रत्ययः।
 वप्रत्ययान्तः।

Bలగి ఒండు ひંల్లలశడల్లి ఎల్లల ధాతుగణగఆ ధాతుగళన్ను బళః




भ्वादयः ఎంబ గణదల్లి బరు山ు బळుతెలశ ఎల్ల ధాతుగఆస్ను


 బహશఃద్దారె．





＊सम्यक् प्रकारेण एधितः समृब्दिं गतः ఎ०బ ధాతుฝిన ‘समेधितो’ ఎంబ யబద山న్ను బఆసిద్దారె．









＊पृची सम्पर्चने ఎ०బ ధాతులిన ‘सम्पूक्ते’’ ఎంబ 山己దద బङ？







* विजिर् पृथग्भावे ఎంబ ధాతులిన 'अवेवेक्' ఎంబ Шదదద బళचे.




## "दिवादि" గణణద లుదాळరణణెกఆు:-






 "स्वादि" nణద లుదాळరణొగైు:-






## ＂तुदादि＂$n ణ \varpi ~ ల ు ద ా \varpi ర ణ ొ ె ౖ ళ ు:-~$

＊पुर अग्रगमने ఎంబ థలతులిన ‘पुरन्’ ఎంబ 山்దబస్ను బళసిద్దారె．



＊रुम्भ रोभार्थे ఎంబ ఢాతులిన ‘रुम्भन्ति’ ఎంబ 山ుదబస్ను బళసిద్దారె． ＂గुधादि＂గణణద లుదాळరెణిగళు：－




 $\dot{\sim} \boldsymbol{\omega}$ ．

＊Fि इन्धी दीप्तौ ఎ०బ ధాతుふిగి లుదలळరణొయలగ ‘ऐन्ध’ ఎంబ 山ుద．

山己ద．
 ய்ద．
 $\dot{\sim} \boldsymbol{\omega}$ ．




＊स्कम्भु रोधने सौत्रो धातु：ఎంబ फాతుఎిగి అుळృळరణణయాగ ＂विष्कभ्नाति＂


## ＂चुरादि＂గణద లుదాळరణొగఆు：－

－सङ్ఘेत आमन्त्रणे ఎంబ ధాతునిగె లుదాळరణణయయాగి ‘संसङ్హेत्य’ ఎంబ シँच．

＊कुह विस्मापने ఎంబ ధాతులిగి లుదలळరణేయాగి ‘अचुकुहत’ ఎంబ نँద．
＊कथ वाक्यप्रबन्धे ఎంబ ధాతుఎిగి లుదాळరణొయాగి ‘अचकथत’ ఎంబ نँШ．
＊कुमार क्रीडायाम् ఎంబ ధాతుఎిగి లుదాळరణణయయాగి＇कुमारयमाणौ＂ ఎంబ 山己ద．







＂सप्तमः प्रक्रियानिर्देशात्मकः कल्लोलः＂
 तिङन्ते णिच्प्रकरणम्＂ఎండు ய్ర్రంభిసిద్దారె．రౌముङరణరు＂प्रक्रियानिर्देशात्मक： कल्लोलः＂ఎండు ळేసరిసిద్దారె．
＂अथ तिङन्त्ते णिच्प्रकरणम्＂ఎ०బుఱుळస్ను णयन्तप्रक्रिया＂ఎండు
＂अथ तिङन्ते सन्प्रकरणम्＂ఎ०బుШుదస్ను सन्नन्तप्रक्रिया $\omega ం డ ు$
"अथ तिङन्त्ते यङ्प्रकरणम्" ఎ०బుఐుదస్ను यङन्तप्रक्रिया ఎండు
"अथ तिङन्त्ते यङ् लुक्प्रकरणम्" ఎ०బుఐ్చుదస్ను यङ् लुगन्त्र प्रक्रिया ఎండు








एयन्तप्रक्रियाద లుదాळఠరణొగఆఆు:-
 ఎంబ Јబ్ద.

- लभेश्च $\omega 0 బ$ సైత్ర్,
 ఎంబ Јబ్ద.

 Јబ్ద.
सन्नन्तप्रक्रियाద లుదాळరణణైधు:-
* ज्ञा अवबोधने धातोः कर्मणः समानकर्तृकादिच्छायां वा ఎ०బ त्స०ड्णु. లుదలळరణేయాగి ‘अचुचुरत् ఎంబ Јబ్ద.


 'अपिपृच्छिषीत्’ ఎ०బ Јబ్ద.
 ఎంబ Јబ్ద．

यङन्त्रप्रक्रियाळ లుదాळరణణెగెభు：－
＊ये विभाषा＇，यस्य हलः，ఎ ఎంబ 山゙ద．
 ఎంబ 山己దు．
 ఎంబ 山己దు．
＊ईघ्राध्मोः ఎ०బ సं兀 यङ्लुगन्तप्रक्रियाळ లుదాळరణణైళు：－

 نШ．
 யబద．

नामधातुप्रक्रियाळ లుదాळठణछึतతు：－
 ఎంబ ய்ద．
 ఎంబ ய山ద．
＊＂कण्ड्वादिनिर्देशोडष्टमः कल्लोलः＂ఎంబ ఎం\＆సేయ అధాల్యయడల్లి




ఈ అధ్యాయబల్లి భటేల్టొజిదిల్ష్రహరు＂कण्ड्वादिभ्यो यक्＂ఒందేల



＊＂चरणाञ्चकार＂ఎ
＊तन्तस दुःखे ఎంబ ధాతుฝినింద ‘तन्तस्यसि’ ఎంబ Шుదద．

－इरज ईर्ष्यायाम् 凶०బ ధాతుఎినింద ‘वीरज्यन्ति’ ఎంబ யШద．
＊हृणीङ् रोषणे ఎంబ ధాతుฝినిండ लज्जायाञ्च’ ఎంబ Шబడ．
＊वरण गतौ ఎంబ ధాతుటినిండ＇अवरण्यताम्’ ఎంబ 山己ద．
－उरस् बलार्थः ఎ०బ ధాతుఎినిండ ‘औरस्यत्’’ ఎంబ Ш山己ద．
＊भुरण धारणपोषणयोः ఎ०బ ఢాङువినింळ ‘भुरणित’ ఎంబ ङ゙ద．
＊अरर आराकर्मणि ఎ०బ ధాతుఎినింద ‘सपर्यन्ति’ ఎంబ Шబద．
＂पद－वाव्य－लकारार्थनिर्देशात्मको नवमः कल्लोलः＂ஆ అధ్యాయుల్లి
 2．＇अथ भावकर्मतिङ् प्रकरणम्’，४．＇अथ कर्मकर्तृतिङ् प्रकरणम्＇．भ．＇अथ लकारार्थ
 ఎండు ळేసేరిస నంతర－

๑．Шబబ ఎంబుฝుదరఔయయల్లి ‘आत्मनेपदप्रक्रिया＇，‘परस्मैपदप्रक्रिया’，ఎంబ ఎరడు ట్ర్రియేగఆు．





 అగత్యఱాగిది．అడు \＆లగిది．
＂आत्मनेपदप्रक्रिया＂ळ లుదాळరణొగఆు：－
 ఎంబ 山己ద．

 نँద．
 ジద．


 ఫ्र०యतఆङన్ను ‘प्रकाशानस्थेयाख्ययोश्रः’’ तिष्ठन्त्यउस्मिन् जनाः विवादपदनिर्णयार्थमिति स्थेयो विदादपदनिर्णेता अथवा तिष्ठति विश्राम्यति विवादपदनिर्णयोउस्मिन्नित्यर्थे बाहुलके अधिकरणे ‘अचो यत्’ ‘स्थेयो विवादस्थानस्य निर्णेतरि पुरोहिते’ इति मेदिनी। अतो राजसुतं


 ＂पराकरोत्＂ఎంబ ఎరడు யబడగళస్ను నిలఱిద్దారె．
 ఎంబ யైద．




 ＂अपीप्यत＂，＂अशीशायत्＂। ఎంబ ఎరడు 山゙దగళస్ను నిలఱద్దారె．





भावकर्मप्रक्रियाळ లుదాळరణైగఆు：－
 भूयते ఎంబ ఎరడు Шబదగళన్ను నిలఱద్దారే．
＊घुमास्थां इतीत्त्वम् ఎ०బ షंఎड్ర． نँద．


 ఎంబ 山己దు．
 نШ．
 उपदेशेगशिति॰ इत्यत्र अशितीति कर्मधारयादित्संज्ञकराकारादौ निषेधः। एरा
 कर्मकर्तृप्रक्रियाळ లుదాळరణछึగఆు：－
 ＂असिस्तस्य＂ఎంబ Шెదపస్ను లుల్లిలబిసిద్దారె．


＊दुहश्च इति वैकल्पिकश्चिण् ‘न दुहस्नुनमां यक् चिणौ’ इत्यनेन दुहेर्यक एव निषेधात्
 సిద్దారె．
 ＂असृज्यत्＂ఎంబ யుడైన్ను లుల్లెల బిలిద్దారె．
 யబదజన్ను లుల్లిల విసిద్దారె．
 యన్ను चठరత मां श्रीमत्पादमूले अनयत् इति विवक्षायां मुख्यकर्मणः कर्तृत्वविवक्षयाउपि गौणकर्मणो वर्तमानत्वात् ‘सकर्मकाणां प्रतिषेधो वक्तव्यः’ इति

लकारार्थप्रक्रियाळ లుదాळఠశణెतఆు：－
 யుద山న్ను లుల్లాల బిసిద్దారె．
 ＂अभुञ्ज्वहि：＂ఎంబ జ山దむస్ను లుల్లిల బిసిద్దారె．
 ఎంబ 山ుద山స్ను లుల్లెలబిసిద్దారె．
－आरांसावचने लिङ् ఎంబ خై யుదజన్ను లుల్లాల బిసిద్దారె．
 யబదむస్ను లుల్లిల బిసిద్దారె．
 யుదేన్ను లుల్లిల బిసిద్దారె．

 గఆన్ను నిలిద్దారె．

प्रकीर्णकनिर्देशात्मको दरामः कल्लोलः：－

 అధ్లాయయబన్ను రజిసిద్దారె．




－पुष पुष्पौ भ्वादिर्दिवादिश्श ఎ०బ సं兀ड్ర． पुष्यति＂ఎంబ 山己దむస్ను లుల్లిల బిసిద్దారె．
 జుదచన్ను లుల్లిల విసిద్దారె．
 లుల్లిలబిసిద్దారె．
 జుడ山న్ను లుల్లాల బిసిద్దారె．
 ＂महति＂ఎంబ 山己దేస్ను బళః $D_{D}$ రె．


＊महीङ् पूजायाम् कण्ड्वादिः ఎ०డు तंगड्र凶స్ను ळึङङ＂महीयमानः＂ఎంబ

 బళఃసద్దారె．


 బహసిద్దారె．
 బళఃబద్దారి.
 బళఃిద్దారె.
రంజేగళ ఎిమిధేేగి ఆయాయా ధాతుగళు ముతల్త అఱుగళా గణగళు
 யరిజయిసిద్దారె.

कृदन्तनिर्देशात्मक एकादशाः कल्लोलः:-
ి్రిల రాముహరణరు ఈ చలిల్లలదల్లి అనిలも $ి భ ా గ గ ళ న ్ న ా గ ి ~ ఎ ి భ ా గ ి స ~$ ద్దారె. అШు-
०. कृत्यप्रक्रिया।
9. पूर्वकृदन्तप्रकरणम्।
2. निरुपपदकृदन्तः।

ङ. सोपपदकृदन्तः।
भ. उत्तरकृदन्तप्रत्ययाः। ఎండు ఎిభాగిసాద్దారె.

๑. कृदन्ते कृत्यप्रकरणम्
๑. पूर्वकृदन्तप्रकरणम्
2. उत्तरकृदन्तप्रकरणम्



कृत्यप्रक्रियाळ లుదాळठణణెగఆు:-


 ఎండు 山ుదదబన్ను ఈథియల్లి అళఎతిసిద్దారె．











 జుదజన్ను ळొలిదాద్దరర
＊＇रयाद् व्यधासुसंस्वृतीणवसावहृलिरिलषश्वसश्च इति अतिपूर्वकादिण् घातोर्ण：’
 ळొలిద్దారె．
 ळెలిదాద్దార





－कर्मण्यण् ఎంబ సं兀త్ర凶స్ను ळొఆ సంతర＂विस्मितिकारे＂ఎంబ Шుదఎస్ను ळొలిద్దారె．
＊शीलकामिभक्ष्याचरिभ्यो णः ఎంబ ఎాతిశచపస్ను ळొలి సంతర

 జుదెన్ను ळేలఆిద్దారె．
 ळొలఆర్దారె．
 Шెదబస్ను ळోలతిద్దారె．

## उत्तरकृदन्तడల్లి ळొలఆలాగిరుळ లుదాळరణణైళు：－



 జెదむన్ను ळొలిల్దారె．
 Шెద山న్ను ळొలతిద్దారె．
＊स्फुरतिस्फुलत्योर्घजि इत्याकारः ఎ०బ त्సొత్రబస్ను ळొఆి సంతర



＊यज्ञे समिस्तुवः इत्यनेनाधिकरणे घज् यजे इत्यर्थः，ఎ०బ तై నంతర＂संस्तावे＂ఎంబ 山己డెస్ను ळలతిద్దారె．

## అญి હిత్ట్రణిగఆు:







## प्रथमोऽध्यायः

## సెత్తెఱొలesధ్యాయి

## 




















## క్రి, రాముహరణర క్లెలి:-




 సెమున్టయిసిద్దారె.

 ద్దారె.







 మింగఱిసిద్దారె.



 యల్లి క్రి, రాముహరణరు నిలఱదద్దారే అంతळ లుదాळరణెగఆల్లి శలజన్ను






 अभाषितपुंस्काज्चति साहचर्येण आदाचार्याणाम्-इत्यात्वम्" ${ }^{\circ}$
 ర్రి. రామురణత్రిயలఠలాస్త్రిగङు "चरित्रस्य भाव इति ष्यझि षित्वान्डीषि हलस्तद्धितस्येति यलोप:"। ${ }^{-}$

 ळొలిద్దారె.
 इत्यधिकारे ‘तुमुन्गवुलौ क्रियायां क्रियार्थाया ‘मिति णवुलि’ अकेनोर्भविष्यदा धमर्ण्ययोरिति" षष्ठीनिषेधः ${ }^{\Omega}$ నిeæిద్దారె.
 "उग्रं सत्यं यस्येति निपातनात् विरोष्यस्य पूर्वनिपातो मुमागमश्रेतीजन्तात्सात्य मुग्रिशब्दात् दैवयज्ञीत्यादिना वैभाषिकः ष्यङ् । $ఎ ం డ ు ~ ฝ ి ల డ ळ ా గ ి య ం, ~$戸రళఱాగియిం నిఱిద్దారె.
 యల్లి నిఁఔరు山 ఎిఎరణశయు ఃొగిది.

णवुल्तृचाविति कालसामान्ये णवुल् तेनात्र तद्योगे षष्ठी ओदनस्यपाचक इतिवत्। भविष्यति गम्यादय इत्यधिकारे विहितस्य तुमुन्गवुलाविति एवुलो योगे तु
 దస్ను ేెలిన్త్తరతలగి నిలిద్దారే.
 ేళళగిసంతే ळొతిద్దారె.
"पञ्च वा षड्वेति संख्ययाऽव्ययेति बहुव्रीहौ, डचि पञ्चषाणां वर्षाणां भूत इति ‘तमधीष्टोभृतोभूतोभावीति’ प्रकरणे ‘वर्षाल्लुक् चेति’ विहितस्य खस्य ठ््ो वा ‘चित्तवति नित्यम्’ इति लुक्," ఎ

सुदिनं पुण्यञ्च तदेवाहः इति विग्रहे प्रशास्तवाचकसुदिनराब्देन कर्मधारये ‘राजाहः सखिभ्यष्टच्’, ‘अह्नोऽह्न एतेभ्य’ इति प्राप्ते ‘उत्तमैकाभ्याञ्चेति निषेधे 'अह्नष्टखोरेवे’ति नियमेन ‘नस्तद्धिते’ इति टिलोपे ‘रात्राह्नाहाः पुंसी’ ति बाधित्वा ‘पुण्यसुदिनाभ्यामह्नः


 ఎండు లిన్తెరపలాగి కిఅిసిద్దారె.

"सदा सर्वदा गतिसम्मुखीभिः अथवा सदागतेर्वायोः सम्मुखीभिः, सती आगतिः सदागतिस्तत्सम्मुखीभिर्वा, सती ‘समीचीना या आसमन्ताद्रतिस्तत्सम्मुखीभिर्वेति विग्रहः, अपरेषां पतीनाम् रक्षकाणाम् अपरासां पतीनां वा पराङ् मुखीभिः (दिक् पूर्वपदान्डीप)।







ఆరనియ Јరంగగద ంంలనిల లెల్లలచదింద ఈ చథేయు ఆరంభ ఎాగుత్తృడి.
"ततः कदाचिदध्यास्त वसंतसमयोत्सवे। देवीकृतं तदुद्यानं स राजा सातवाहनः॥
विहरन् सुचिरं तत्र महेन्द्र इव नन्दने। वापीजलेऽवतीर्णोभूत् क्रीडितुं कामिनीसखः ॥ सा जलैरभिषिंचंतं राजानमसहा सती। अब्रवीन्मोदकैर्देव परिताडय मामिति ॥
तच्छुत्वा मोदकान् राजा दूतमानाययद् बहून्।
ततो विहस्य सा राज़ी पुनरेवमभाषत ॥
राजन्नवसरः कोडत्र मोदकानां जलान्तरे।
उदकै: सिक्च मा त्वं मामित्युक्तं हि मया तव॥
सन्धिमात्रं न जानासि माइब्दोदकराब्दयो।
न च प्रकरणं वेत्सि मूर्खस्त्वं कथमीदृशः ॥
इत्युक्तः स तया राजा इब्दशास्रविदा नृपः।
परिवारे हसत्यंतरर्लज्जाक्रान्तो झगित्यभूत् ॥"
 ळొఆుత్తారి-
"सातवाहन एकदा वसन्तोत्सव समये नन्दनेऽमरपतिरिवनिजारामे रामा दीव्यन् गाहमानजनतापहारिणि वापिणि रमणीये जलक्रीडां कर्तुं तत्रत्यवापीमवतीर्णः तत्र व्यात्युक्षि कायामत्यायताक्षीणां करवारिभिरभितः सिंञ्चस्तदभिषिक्तिमसहमानया शिरीषसुकुमाराङ्या स्वकीयान्यतममहिष्योक्तः ‘देव, मोदकैर्मां ताडयेति’। तदाकर्ण प्रिया मे मोदकैस्ताड्यमाना मात्मानमिच्छतीति बुद्ध्या नृपतिर्द्रतं वचनकरेण बहुमोदकानानाययत्। तानालोक्य विहस्य साऽभाषत- राजन्नत्र जलान्तरो कोऽवसरो मेदकानाम्? उदकैर्मां मा सिक्च इत्येवमुक्तस्त्वं माइब्दोदकराब्दयोः सन्धि प्रकरणञ्च नावगच्छसीत्येतावान् मूर्खः। परजनमेजयोऽपि राब्दशास्त्रविदा तथैवं पराजितो राजा सत्रीडः परित्यक्तजलक्रीडः, जातावमानः, परित्यक्तकार्यान्तरावधानस्तत्क्षणं निजवासमविशत् ।"













 భాషగగఆింత భిన్నదాద ఎిలాひగఆ భాజేయల్లి బరేదసు.




 రఁతియాగిひె．

 （లిひ）．

शिवः，হार्वा，इमशानप्रियः，उमाधवः，राङ्रः，शाम्भुः，शशिरोखरः，शाशिमौलिः， विश्वेशः，धूर्जटी，वृषध्वजः，ईश्वरः，विश्वेशः，कपर्दी त्रिनेत्रः，त्र्यक्षः，महेश्वरः，शूलिः， वृषलक्षणः，भैरवः，गिरीशःः।


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भवानी，जगज्जननी，हेरम्बस्याम्बा，शार्वाणी，दाक्षायिणी，शिवा，पार्वती，गौरी， शाम्भवी，गिरीन्द्रजा，गिरिजा，शाक्ती，कात्यायिनी，काली，चण्डी，पर्वतनन्दिनी।




＂मध्वरी，हरिः，शौरिः，विष्णुः，नारायणः＂

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ब्रह्मा，धात्रंराः，पितामहः，विरिक्चिः，प्रजापतिः，धात्रा，वेधसः，चतुर्मुखः।

कुमारस्वामी，कार्तिकेयः，कुमारः，षाण्मातुरः，स्कन्दस्वामि．

 సం
ముంత్రిజేదదాひచగళు అమూత్యాదిగళు：－



केसरी，सिंहः，व्याघ्रः，मृगेन्द्रः，मृगाधिपः।
ఆని 山రదమాజఈశగుత：－
हस्तिनी．करिणी，द्वैपः，गजः，मातंगः，नडगासः
（లอఆద గిడగఆస్ను తిస్నుబ ఆనె）

## చుదురి అథ్ జిండుむ むదగగఆు：－


 ळావు ఎంబ అథక జియడుఎ むదగళు：－

सर्पः，अहिः，भुजङः，नागः，पन्नगः，डुंडुभः।





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राबरः，लुब्दकः，व्याधः，पुलिन्दः，निशाधः। शదठంత నది జలృలయా
 ¿セగిひె．

## 

कैवर्तः，धीवरः，दाइःः，शाफरः।





कैलासपर्वतः，मन्दरपर्वतः，कालज्जरपर्वतः，विन्द्यापर्वतः，उरीनगिरि，काञ्चन


अम्बुलसा, ऊर्वशी, मेनका, प्रमद्वरा, तिलोत्तमा, रम्भा, सुरभिदत्ता, अहल्या। ఇల्లे


ขుณి-ఋనిగిళ ळెసరుగ్రు:-
गालवः, विश्वामित्रः, किन्दमः, जमदग्निः, शाण्डिल्यः, दुर्वासः, करयपः,।














## 




○. संयाव-ळల्ड़.
9. पेटक- シंटて.

§. कुण्डलिनी - జలయబి.

๒. रसगोलक-ठतनतుల్ల.


 చరిద కింఱిగళిందు చరరయయుత్తారే.

-. पूडी - Ш्யొలర.


भ. पर्पटः - ळЖ్టై
(2) అన్నద జీอతి నంఒజజిళ్టుజ తింఔిగళు:-

9. रामठजीरकादिविविधाभिधार्यप्राज्याज्यसुगन्धितद्रव्याभिधारितसहरिद्रशतपपुष्पै
-लाकुस्तुंम्बुरुमरिचलवङ्गतुवरिकामाषमूल्यमुस्तकचणकसतीनकसूपै:=







2. उग्रगन्धाराजकर्णिकासोपस्करवेल्लपटोलमहाफला सप्तलापालकवास्तुककोशात कीमूलिकाकर्कारुबिम्बिकावृत्ताकालुप्रभृत्यनेकराकै:=అజळా0ినఎत్ను,





§. स्वादिष्ठाभिस्साकरपा कादधिबटकादिविविधवर्णनातीतषड् रसव्यञ्जनैः-



 తితియలునెధ్య.

 రొతియాగిబె.

निषधराज्यं, अवन्ती, पाण्ड्याज्यं, पाञ्चालनगरं, कन्याकुब्जराज्यं, मगधराज्यं, वङ्गाज्यं, गोकर्ण, श्रावस्ति, विटंकपुरः, कार्कोटकपुरः, वर्धमानपुरः, कनकपुरिः, माकन्दिका, तिमिरा, वाराणसी, वलभिः, श्रीकण्ठदेशः, मालवदेशः, त्रिघणटपुरः, कुसुमपुरः, काम्पिल्य,।
 ిలిల రాముహరణరు ఓడుగరిగె யెరひయియిద్దారె.



 3ిఃిసద్దారె.

## 




 ఎరడ్యం ఫ్టృగఆిండ బారిసుత్తారె.
2. पणव-उ०2.
§. वेणु-屯ొఆలు.
भ. करताला - ఫ్




प्रातिभेन ब्रह्मसूत्रेण, उपनिशादा च गोष्घा, गीतया च गीत्या, सुवर्णमयेनालंकारेण, प्रकृष्टेन छन्दानुरोधेन, प्रसादकेनगुणेन, आन्वीक्षिकीभिः, प्रस्थानत्रयीभिः, साहित्य








๑. इोणी - इोणात्प्राचाम् सूत्रेण स्त्रीत्वम्।
9. रोहिणी - वर्णादनुदात्तात्तोपधात्तोः नः। (४०Ш)
2. नीला-(నొలి)

ध. कल्माषी।




ळేసరుగఆాగలిల ధాన్య తరచలరిగఆ ळేసుగుళాగలిల షొల ఈథా ¡రతత్లాగరదల్లిల్ల.










 అండ゙రె యంచచర．

2．अत्यारूढ्या－अत्यन्त् धृष्टता। అత్యంఠ నిజ్ట్రురవాద బుద్ధియుళ్ళుひరు

भ．वरिवस्यापरः－आराधकः।
 అత్యంత ఇఙ్టియొళ్ళైను．





2．पदिक－山దాతిదళ నెలదల్లి యుద్ధమూడుఱ 户్లృనిచురు．
§．धानुष्क－బిల్లు బలణగఆింద యుద్దఱూడుఎఎరు．
भ．आसिक－ఈత్తియింద యుడ్ధహూడుబపరు．



భారతజేన్ను ఎణిణశలు బళసిచ్రంఱిద్దారె. ఆయా ఱృత్తిగనుగుణమాగి



ก. वैतनिक- बंలउానుధారపత జనరు.

 జిలవిసు山పురు.
 జనరు.

भ. लावणिक - లుఱ్ట్సN్ను Шూరు山 జనరు.












"गणावतारो जातोऽयं गुणाढ्यओ नाम।"
గణడ అపతారపాగి ఈ గుణలఢ్యను జనిసిద్దానె. గుణగఆ అగరవెఁ


 త్తనగి.
"दत्ता मे वासवेनैषा तुष्टेनेति स भूपतिः।
नाम्ना वासवदत्तां तां तनयामाकरोत्तदा॥
दत्ता मे वासवेनैषा तुष्टेनेति स भूपतिः।
नाम्ना वासवदत्तां तां तनयामाकरोत्तदा॥"
ఇండ్ర్రు సంతుజ్టనాగి నిఱిద 山రదింద జనిసిదజఱాద్దరండ ముగఆిగ

 చండంతిది.
2. "प्रियादन्तोच्छ्तितात् पुष्पात् संज्ञां न ज्ञातवान् यतः।

अतः स पुष्पदन्ताख्यः सम्पन्नो गणसंसदि ॥ ${ }^{2}$

 ळేసెరినపనాదసుు.

"नाम्ना वररुचिश्चायं तत्तदस्मै हि रोचते। यद्यद्वरं भवेत् तत्तदस्मै हि रोचते ॥"


 రాములరణరు ळొలఆుఙుదిల్ల.
 एवं वत्सेषु राजत्वात् वत्सराजः सुगात्रि सः। पाण्डवान्वयसंभूत्या सोमवंशोद्धवस्तथा॥ नाम्नाप्युदयनः प्रोक्तो देवैरुदयजन्मना। ${ }^{\ominus}$

 డల్లి జనిసాద్దంంద లుదయిన ఎందు 山్లుసద్ధనాగిద్దాని.

"मम वृत्तान्तो नाम्ना पिंगलिकाप्यहम्।
अबाल्याग्निक्रियाधूमैर्यन्मे पिंगलिते दृरौ ॥"०
 యిండ నస్న もణ్ణుగటు మెంంబణ్ణ్ణ కిరుగిబె.
 బిజరిసిద్దానే.
"कं दर्पयामीति मदाज्जातमात्रो जगाद च।
तेन कंदर्पनामानं तं चकार चतुर्मुखः ॥จ

 ఎండు ळేసరన్నిట్టైుు.





 ఇల్లి స్సొష్ష్మ దాగి ळొలిద్దారె.











 నిఎఁఃశిద్దారె.



๑. "नहि मोहयति प्राज्ञं लक्ष्मीर्मरुमरीचिका" $\bigcirc$
 Шన్ను Шూట్తిసలారళు."
9. "अकाण्डपातोपनता कं न लक्ष्मीर्विमोहयेत्"’
 గిงఆిసుఙుదిల్ల?"
2. "ईई्ष्या हि विवेकपरिपन्थिनी",2

४. "शीलं हि विदुषां धनम्" "

5. "प्रियबन्धुविनाइोत्थः इोकाग्निः कं न तापयेत्"

असंसारं जगत्यस्मिन्नेका नित्या ह्यनित्यता" $\bigcirc$
 తలనె సుడడు?"

ᄅ. "ज्ञानमार्गे ह्वहंकारः परिघो दुरतिक्रमः।
ज्ञां विना च नास्त्येव मोक्षो व्रतशातैरपि ॥
"स्वर्गस्तु न मुमुक्षूणां क्षयी चित्तं विलोभयेत्"’


 బలరడు.
"अक्लेशालभ्या हि भवंत्युत्तमार्था महत्मनाम्।
जन्मांतरार्जिताःस्फारसम्स्काराक्षिप्तसिद्धयः॥"2

 థలలాగి సిద్ధిగళు అజరిగి తాఎాగి బండు ఒదగుత్తటి.
"किन्तु दृष्टनष्टापदोऽपि दुष्टः स्वभावं न परित्यजन्ति"ः
 బిడు山్రాల ఇల్ల.


"अदत्तां गुरूभिः स्वेच्छमुपकोशां कथं भजे।
वरं हि मृत्युर्नाकीर्तिस्तत्सखीटृदयं तव॥"פ


"‘वरं पत्यौ प्रवासस्थे मरणं कुलयोषितः।
त तु रूपारमल्लोकलोचनापातपात्रता ॥"2.


"प्रवासस्थे भर्तरि कुलीनयोषितो मरणं श्रेयो न पुना
रूपैकपक्षपातिलोकलोचनापातपात्रतेतिः




నిలరస్ను నిలడుక్తిరలు హత్రులిన అళివిగలగి తానేల అదస్ను ిిన్నుతా ఇరుఱ
 ळొల్రతల్తనగి.
"पाणेभ्योऽपि हि धीराणां प्रिया शातृप्रतिक्रिया"
"वृत्तिः कष्टं कृरा जिगीषवः"
"अबुद्ध्वा चित्तमप्राप्य विसंभं प्रभविष्णुषु।
न स्वेच्चं व्यवहर्तव्यमात्मनो भूतिमिच्चता॥"
 ఇజ్ట్ట,

ేజ్ట్ట్ర హత్రుగళన్ను గiల్లబయసు山 జనరు చంరరరాగుత్తారె.




"पाण्डित्यं विना ह्येषा लक्इमीर्न प्रतिभासते।
विभवैः किं नु मूर्खस्य काष्ठस्याभरणैरिव ॥"ः


 ఒడేయనెండు గెరి ఐొలిద్దారె.

సంతర ఎ్లాశరణఎన్ను ఎల్ల్ల ఎిద్యిగళ ముబిఎందు అందరే ఎల్లా
 ితిసిద్దార్రె.
"ज्ञायते सर्वविद्यानां मुखं व्याकरणम्",








 उరణరు.
 క్రిలుఠిగళు బళసిద్దారె.

## లుష్మూలంణారదద లుదాळపణిగెళు:-

शरीरमेतज्जलबुद्बुदवन्नश्वरं, श्रियश्र प्रवातदीपवन्निर्वाणावसाना इत्येतत्कृते स एव गोत्रजैः सह युध्येत य ऐहलौकिकसौखमतिरिच्य नान्यदुत्सुकः।

 దాయోదిగళిృందిగి యుద్ధద బూడలు లుత్లుచనాగిల్ల.



सातवाहन एकदा वसन्तोत्सवसमये नन्दनेड्मरपतिरिव जलक्रीडां कर्तुं तत्रत्यवापीमवतीर्णः। ${ }^{-}$





अदहञ्च तस्य देहं दहन इव दारू दारुणो दायितादाह सम्वादःः ${ }^{\Omega}$
 దారుణ్లపస్థెయన్ను ఐొంందితు.

दुःखदैन्यदेहाविव द्वौ दारकौ विदारकौ हृदो दर्शाकस्य तद्देन्यदशायाः।



ब्राह्मणी सा सल्लिलसिक्ता तप्ता भूपिव समुच्छवसन्ती। ${ }^{2}$
 వాగి లుసిరాణిదహు.




"विचिन्त्यंश्रण्डमहासे नश्रण्डीमन्दिरमागत्याभ्यर्चितचण्डीकः"





तावदेवदेवदेवमहादेवगणोत्तमो गणः पुष्पदन्तस्तत्कथाशुश्रूषासमासक्तमना नन्दिना प्रतिषिद्धोडपि अन्तःप्रवेष्टुं, योगवशादलक्षितस्तत्र प्रविइय विद्याधरसप्तकापूर्वचरितमा कर्णितवान्। ${ }^{\text {r }}$


 శిలఆిదను.

 రాములరణత్రిలెలిగళు.

"अर्थेसत्यर्थभिन्नानां वर्णानां सा पुनः श्रुतिः"ः

 యృమపృలంళృర.
"एतेनामन्दं नन्दं प्रति क्रुद्धश्चाण्क्योऽवलिस्यमान इवापादमस्तकं क्रोधशिखि शिखया शिखां च स्विकामुन्मुञ्चन्नसिधारासगन्धां सन्धामिमामाबबन्ध",



तुल्याभिलाषां मुनिकन्यकामेकाम् अवलोक्याकस्मात् कन्दर्पशार शार्यतां गतः स मुनिभिः राप्तोडधुना अवतीर्णः। ${ }^{2}$





ఇల్లి హర ఎంబ 山బదవు ఒమ్మే మున్యథ ఎంబ అథFదల్లియబ 山ుత్తు

 ద్దారే రాముహరణరు.






## రామాయణదద దృష్ట్ట్ర:-

"रावणोच्छित्तये सीतावियोगस्य सोढारं राममुदाहृत्य विजिगीषोर्नृपस्य कार्यवशात्क्लेशासहिष्णुतां प्रमाणीकृतवान्"ः


 బరుత్తడి.

## ముळాభారతచ దృష్ట్టాంత:-





"मृगयाव्यसनी स चैकदा वनं गतो मृगरूपधारिणं सवभार्यया सह कन्दर्पके लिकारिणं कन्दर्पनामानं मुनिं पन्चशारविद्धमपि व्याध इव शरेणानुविष्याधा परित्यक्तनिजरूपो मुनिः कणठगतोत्क्राम्यदसुरतिविषण्णमपि निषण्णं पुरो मुक्तेष्वासं मुक्तनिःश्वासं शाशाप पाण्डुम्" $\left.\right|^{\text {P }}$

##  ఆరఃజేలంณిరుపుదర ఔఔత్య:-











ค. इరరుひ
-. யృణరిని
2. Ш్లె



 గురుగళు ఎష్టలఁథలధ్యలయను. ఈ గురుషిన బళియల్లియిల ఎ్యల ముత్తు

 జన్ను ఐీలందిద్దురు.








## చాతంత్ర ఎ్యాచరణద ఈథి:-















## లుథ్సందార:-

"प्रयोजनम् अनुद्दिरय मन्दोगपि न प्रवर्तते" ఎ०బ లుశ్తంయొ ळొఆుఎంత ఈ


























दीपतुल्ल्यः प्रबन्धोऽयं शब्दलक्षणचक्षुषाम्।
हस्तादर्श इवान्धानां भवेद् व्याकरणादृते ॥

## ేత్తతయయల్లి నడియొఱజరిగి:-

इदमन्धं तमः कृत्स्नं जायेत भुवनत्रयम्।

यदि रब्दाह्वयं ज्योतिरासंसारं न दीप्यते ॥
"एकराब्दः सम्यग्जातः सुष्टुप्रयुक्तः स्वर्गेलोके कामधुग्भवति महीतले" रूपान्तरेण ते देवा विचरन्ति महीतले।
ये व्याकरणसंस्कारपवित्रितमुखा नराः॥
यद्यपि बहु नाधीये तथापि पुत्र पठ व्याकरणम्।
सकलइराकलो मा भूत् स्वजनइश्वजनः सकृत् राकृत्।
'अचीकमत’ यो न जानाति यो न जानात्यवर्वरी।
‘अजर्घाः' यो न जानाति तस्मै कन्या न दीयताम् ॥

## అఱిళెజ్ట్రణిగళు:




















๑. कौमुदी कथा कल्लोलिनी, पु. ?०.
9. कथासरित्सागरः त. ४, इलो.१४. पु. ४४.
2. कथासरित्सागरः त. ४, इलो.४१. पु. ४८.
๑. कौमुदी कथा कल्लोलिनी, पु. ?०.
๑. कथासरित्सागरः त. ४, इलो. २२७. पु. ६०.
2. कथासरित्सागरः त. ४, इलो. २२७. पु. ६०.

9. ఈథాసిత్ల్సెర 山్ల.







๑. 2F.cioc. Ш్..ర. யu山. noc.





## 


 బింగళృరు ఎరశఁనల ముద్రణ ఎంం2．

9．దంณియ ซృఎ్యాదశ్



ᄅ．तैतरीय संहिता．
2．सायणाचार्य भाष्य．
e．ऋग्वेद
巨．யలణినియ కిశ్షె．

 రంగనాథలమృక．（戸్లు．అల）．
 రంగనలాథతయృళ．（山్ల．లల）．
2．$\dot{\text { U® }}$
ఆ．తృత్తరలయ సంగంతర．

2．व्याकरण् शास्त्रका एतिहास्－युधिष्टिर्मीमांसक．
e．संस्कृत्साहित्य का उद्भव् और् विकास．
तैत्तरीय प्रातिशाख्य：

－．Шుळలభారత．
2．व्याकरण् शास्त्र् का इतिहास्－युधिष्टिर् मीमाम्सक्－चौखम्बा सीरीस्．
§．महाभारतम्－गीताप्रेस् गोरख्पुर्：

भ．पाणिनीय शिक्षा－चौखम्बा सीरीस्．
厄．संस्कृत् व्याकरण् का उद्भव् और् विकास्．
2．महाभाष्यम्．
厄．Citical studies on katyayana＇s suklayajurvedapratishakya p． 10.
₹．पाणिनीय अष्टाध्यायी．
ค०．బుశ్తంత్త．

๑๑．OASG，p．56－58．On the aindra school of Sanskrit grammarians．
ก2．ขుశ్తంక్త．
กย．モ๐లిచం．
กタ．ఐతరేయయ బ్ల్రణ్ణ．
దాయుజులాణ：
○．ముळాభారత，లాంతిజెపF．
9．யలణినియు అఱ్ల్రా్యాయిల．
2．யలంంజలియి ముळాభాజ్జ్యび．
§．Шుळాభాజ్య్ర．
भ．யెలంజలియి ముळాభాజ్యం．
๖．అథశ

e．A dictionary of Sanskrit Grammar，Oriental Institute，Baroda，1961，pp． 229－30．
₹．पाराशरोपपुराणम् समीक्षात्मकं सम्पादनम्－सम्पूर्णानन्दसंस्कृतविश्वविद्यालयः वाराणसी．पु．स．९९．
ค०．युधिष्ठिर् मीमांसकः－संस्कृत् व्याकरण् शास्त्र का इतिहास्（हिन्दि）२००७ चौकम्बा सीरीस्．


ก2．ముळాభారత－గిలతాజ్టెసౌ，గినలరబో ய్రుర．

 బొంగఆృరు-ఆం.





๑®. उपाकार् एन्.इ.टि संस्कृत पु. ५९.


9०. पाणिनीय-शिक्षा, सम्पागद एवं हिन्दी व्याख्याकार विद्यासागर डां दामोदर महतो, मोतीलाल बनारसीदास,
๑๑. नीतिशातकम्- भर्तृहरि:-
१2. साहित्यदर्पणः- राजरोखर- पु

๑ย. ひంய్ల్ర రలమాయణ గ-అ




๑巨. త్తృత్తరలయ సెందితె.
20. $\vec{\sim} 0 \vec{\tau}_{6}$ త




28. Da.Rhys Davids; ottokeller.



2ల. संस्कृतसुकवि समीक्षा. बलदेव उपाध्याय- पु. २४१-२५३. वारणासी-१९६३.
2ร. AHistory of Sanskrit Literature.
४०. कथासरित्सागर एक विमर्शात्मक् अध्ययनम्

ย๑. అంతజలఁలద నేరచు.

ఆச. Karnataka through the ages (p. 110).
ఆभ. ซৈЈంత్రప్యాచరణ.
§ङ. पं. रामशरणशास्त्रिस्मृतिविशोषाङ़:- गङानाथ झा केन्द्रीय संस्कृत् विद्यापीठ-अलहबाद-२. १९८५. पु. २.


230. లఘ゙ సిద్ధాంతశొШొదిల.


भ39. सिद्धान्तकौमुदी चंद्रिका, अचार्य विजयमिश्र विरचित, चौखंबा सुरभारती प्रकाशन, वाराणसी, २०११.
939. अधिगमकौमुदी, डां. उदयरांकर झा, चौखंबा सुरभारती प्रकाशान, वाराणसी, २०१३

भ2. लघुसिद्धान्तकौमुदी श्री मद् विद्वद्वर वरदराजाचार्यप्रणीता, गोविन्दभवन कार्यालय, गीताप्रेस्, गोरक्षपुरः, १९९३.
भ४. डां. रामशरणशास्त्रिविरचितम् व्याकृतिवत्सराजम्. पाणिनीयप्रयोगपरं गद्यकाव्यम्. गझानाथझाकेन्द्रीयसंस्कृतविद्यापीठम्, टेक्स्ट् ्सीरीस्,




१९2. कौमुदी कथाकल्लोलिनी, रामशरणशास्त्री, चौखंबा विद्याभवन वाराणसी, १९८९.

అరఃః








## ఝ్య్ర్త్తానా

## 1 లซారగళ అథร విఎరణశ

 అత్యంఠ శరతఱాగి ఎిఱరిస్సత్తడద.







 దల్లి డూడలలరిడి.

2 (సО) 『బ్దひ్తి






 బిరేอఁధగళ ఆధారదిండ బరుత్తడే.

## 

జదాథFగళల్లి ములరురఁతియు 山ృత్తిగలిపే

1. అభిధా Шృత్తి
2. లచ్షణం చృత్త
3. Ш్యంంజనా జృత్తి

లచ్షణా పృత్తియు ఎరడు బగగ

1. Шుద్ధ ల
2. గౌణீల లచ్షణా

 విఐరణాత్మ్ర అధ్యయయస




 యూడుబ ట్రయత్నబ్రు ఆ ఆలఎనదల్లి యూడలాగిది.

## 5 (戸) శ్థానిలంతరతముః శ్సృత్రనిములిక









సృత్రగళల్లి ఆరుఱిధగళిఱె అఐు








## 






## 







山ుس్ముటసు " तददोषौ राब्दार्थौ सगुणावनलङ्ध़ती पुनः क्वापि"





## 
















## 


 అఢ్యయిన నేడేసిది ळలగలడరర భా山లభిబ్యళ్తియ






```
ఇదముంధతముః ఫృహ్స్\mp@code{O జాయిలత భుజNత్రయుమో |}
```






## 








## ๑. ధామిణచ రాష్ట్రిలయత్ట్రె,

פ. ష్రుదిలలిచ రాష్ట్రిలయిక్ట్ర.




## आसिन्धूसिंधूपर्यता यस्य भारतभूमिका।

पितृ भूः पुण्यभूयैक्चैव स वै हिन्दुरिति स्मृतः ॥

 జંల్లలిడి.

## 











 ய్ర్యయ్నిసైలిగిదే.

## 

















## 














 ఎణిఁ సెలెత్తనె.




 ఎదురిగి అఎనస్ను తృణిలఈరిబిడుతుత్తళి.






## काव्यं यइासे अर्थकृते व्यवहारयुदे शिवेतरक्षतये ।

## सद्यपरनिर्वृत्तये कान्तासम्मिततयोपदेशयुजे ॥






















 అబారియాగిద్దేలని.

## UGC NET/JRF/SET GENERAL PAPER (CUMPULSORY PAPER)

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## PREFACE

This book entitled on "UGC NET/JRF and SLET/SET" compulsory/ General Paper -1 has been specially written for the candidates preparing for the "UGC NET/JRF and SLET/SET". it covers the latest revised and updated syllabus prescribed by the UGC for Paper -1 for the above noted examination. This publication aims at helping students with awareness of general teaching, research aptitude, comprehension analysis, deductive and inductive teaching. Specially covered the new subject which is added recently " Indian Logic " is described. They are informative in nature.

The book containing 10 units is strictly in accordance with the syllabus prescribed for National Eligibility Test (NET) conducted by the university Grants commission. Is the examination for determining the eligibility for the post of assistant professor and Junior research fellowship award in Indian Universities and colleges. While compiling this book, I have referred various books, e-journals: I am therefore, in debted to all those authors and people who have directly and indirectly helped me in bringing out this publication I wish to express my deep sense of gratitude and indebtedness to my co authors Dr . Kavitha Biradara , Sri Ramesh Puttannanavar and Sri Arunkumar for their cooperation and tremendous help which greatly helped me to complete this book.

I would like to give an heartly thankful to my colleague Dr Vinay P for correction made by proof reading.

For being a great source of support and well wishers in publishing this book I would like to thank my brother-in -law Sri VENKATESH M and my sister SAVITHA VENKATESH.

I wish and hope that this book proves an honest, laborious and dedicated attempt to satisfy the demands of the students, teachers, researchers to all those who aspire to get placement and promotion in their career.
(DR Anupama B) (Dr Kavitha Biradara) (Sri Arunkumar) (Sri Ramesh Puttannanavar)

- Authour and co authours


## UGC NET

UGC NET is a national level eligibility test for the post of Assistant Professors and Junior Research fellowship (JRF) in Indian universities and colleges.

As far as level of difficulty is concerned, UGC NET is tough and difficult and not just an average clerical type examination. Based on understanding of concepts, this exam tests the aspirant's ability to analyze a given situation. This exam requires regular study and practice. There is a need for NTA NET aspirants to build on analytical ability and application of skills.

## Eligibility Criteria for UGC NET :

## Age:

Junior Research Fellowship : the age limit for JRF is 28 but NTA extended to 31years for 2021 session only.

Assistant professor/lectureship: there is no upper age limit for applying for lectyreship.

## A Relaxation

1. A Relaxation of upto 5years is provided to the candidates belonging to SC/ST/PWD/OBC( non creamy Layer) female/Transgender.
2. Relaxation will also be provided to candidates having research experience, limited to the period spent on research in the relevant/related subject of post graduation degree, subject to a maximum of 5 years, on production of a certificate from appropriate authority.
3. 3 years relaxation in age will be permissible to candidates possessing L.L.M degree.

Total age relaxation on the above ground(s) shall not exceed 5years under any circumstances.

## Educational Qualification:

1. Candidates who have secured at least $55 \%$ marks (without rounding off) in Master's Degree OR equivalent examination from universities/institutions recognized by UGC in Humanities (including languages) and Social Science, Computer Science \& Applications, Electronic Science etc. are all eligible for this Test.

Scheduled Caste (SC)/ Scheduled Tribe (ST)/ persons with disability(PWD) category candidates who have secured at least $50 \%$ marks (without rounding off) in Master's Degree or equivalent examination are eligible for the Test.

Candidates who have appeared OR will be appearing at the qualifying Master's degree (final year) examination and whose result is still awaited OR candidates whose qualifying examinations have been delayed may also apply for this test however, such candidates will be
admitted provisionally and shall be considered eligible for award of JRF/Lectureship eligibility only after they have passed their Master's Degree examination or equivalent with at least $55 \%$ marks ( $50 \%$ marks in case of SC/ST/PWD. Such candidates must complete their P.G degree examination within two years from the date of NET result with required percentage of marks, failing which they shall be treated as disqualified.

## UNIT - 1

## TEACHING APTITUDE

- Teaching Concepts, objectives, levels of teaching (memory , understanding and reflective).
- Characteristics and basic requirements.
- Learner's characteristics. Charecteristics of adolescent and adult learners (academic, social,emotional and cognitive) individual differences.
- Factors affecting teaching related to : Teacher, Learner, Support material, Instructional facilities, Learning Environment and Institution.
- Methods of teaching in institutions of higher learning: Teacher centred vs. learner centred methods (swayam Swayamprabha, MOOCs etc).
- Teaching support system: traditional, modern and ICT based.
- Evaluation systems: Elements and types of evaluation in choice Based Credit System in higher education, compter based testing (CBT), innovations Systems.


## TEACHING : CONCEPTS, NATURE, OBJECTIVE, CHARACTERISTICS AND BASIC REQUIREMENTS

## Introduction

Teaching as an organized system of specific activities aimed to help the learner learn something. Teaching is a planned and coordination of sharing knowledge and experience basically. The prime role of a teacher is to impart information, understanding, and skills to students. Teaching is cognitive, affective, psychomotor aspect. (overall development)

## Instruction

Cognitive.
INDOCTRINATION : Brain washing, belief system. (no question, no arguments).
TRANING : Practice, Habits (Job oriented)

The word "Aptitude" means to develop an ability or skill to do something.
Thus "Teaching Aptitude' can be defined as the development of required ability and skill sets which are essential to be a good teacher.

Teaching is "TRIADIC" in nature i.e it involves three core elements which are

1. Teacher.
2. Student.
3. Subject

Teaching and learning are two process which are interrelated. One of the main aims of teaching is to bring out some positive transformation in students with the enhancement of student's knowledge base. All teaching should focus on enhancing process with no productive learning outcomes of students. However, if the process of teaching is not good then it will be a teaching process with no productive learning outcome. Another vital point to remember is that a teacher although teaches but they learn also. A teacher while teaching students goes through the process of self learning. The process of learning is life long as there is no end level of an individual (be it's a teacher or a student).

## Meaning of Teaching

> Teaching is a process in which one individual teaches or instruct another individual.
$>$ Teaching is considered as the act of imparting instructions to the learners in the classroom situation.
$>$ It is a watching systematically.
$>$ Dewey : considers it as a manipulation of the situation, where the learner will acquire skills and insight with his initiation.

## Important Teaching Definition's

$>$ "The one who teaches is the giver of eyes. - (Indian Proverb)
$>$ Education is the most powerful weapon which you can use to change the world." (Nelson Mandela)
$>$ Teaching - awaken of joy in creative expression and knowledge ( albert Einstein )
$>$ You cannot teach a man anything you can only help him to find himself ( Galileo ).
> "Education is the manifestation of perfection present already in man. Divinity is the manifestation of the religion already in man." (-Swami Vivekananda)
$>$ "The highest education is that which does not merely give us information but makes our life in harmony with all existence." (-Ravindranath Tagore).
> "By education I mean an all round drawing of the best in Child and Man in Body, Mind and Soul/Spirit."(- Mahatma Gandhi).
> "Teaching is intimate Contact between the more Mature Personality and a Less Mature one". (- H C Morrison)
$>$ "Teaching is a face to face encounters between two or more persons, one of whom (teacher) intends to effect certain changes in the other participants (Students) (-Jackson).
$>$ "Teaching is interpersonal influence aimed at changing the behavior potential of another person. (N.L GAGE (Democratic View).
$>$ According to J B Hough and James K Teaching is an Activity with 4 phases,

1. A Curriculum planning phase.
2. An instructing phase.
3. Generalization phase.
4. An Evaluating phase.
$>$ CLERK defines "Teaching refers to activities that are designed and performed to produce in student's behavior."

## Nature of Teaching

> Professional Activity / Specialized Task.
> Interactive Process.
> Science (Cause and Effect) as well as Art (Individual).
$>$ Dynamic Process (So Many Activities Going On At a Time) Full of Energy.
$>$ Dynamic Social and Humane.
> Teaching is a social and cultural process- which is planned in order to enable an individual to learn something in his life. We can describe the nature and characteristics of teaching in the following way:-
$>$ Teaching is a Complete Social Process- Teaching is undertaken for society and by society. With ever-changing social ideas, it is not possible to describe the exact and permanent nature of teaching.
$>$ Teaching is Giving Information- Teaching tells students about the things they have to know and students cannot find out themselves. Communication of knowledge is an essential part of teaching.
$>$ Teaching is an interactive process- Teaching is an interactive process between the student and the teaching sources, which is essential for the guidance, progress, and development of students.
$>$ Teaching is a process of development and learning.
$>$ Teaching causes a change in behaviour.
$>$ Teaching is art as well as science.
> Teaching is face to face encounter.
> Teaching is observable, measurable and modifiable.
> Teaching is a skilled occupation:- Every successful teacher is expected to know the general methods of teaching-learning situations.
$>$ Teaching facilitates learning.
> Teaching is both a conscious and an unconscious process.
$>$ Teaching is from memory level to reflective level.
$>$ Teaching is a continuum of training, conditioning, instruction, and indoctrination.

## Levels of Teaching

The Overall object of teaching is to build the overall personality of the learners and it evolves around the development of learner's capability, thinking and change in the behavior of students.

Different levels of Teaching
$>$ Memory Level of Teaching
$>$ Understanding the Level of Teaching
$>$ Reflective Level of Teaching
Important Points on Memory level teaching (MLT) as proposed by Herbart.

1. Initial stage of teaching. It induces the habit of memorization.

- Memory level teaching emphasis on presentation of fact and information and it's all about CRAMMING.
- Knowledge or information is gained by the learner through memorization.
- It is the initial stage of teaching and induces the habit of ROTE Learning of facts and subject matters
- It provides students the ability to retain and reproduce the learned subject.
- It covers only the knowledge-based objectives of Bloom's Taxonomy. At this level, the student learns to identify, recall or remembers the objects, events, ideas and retain them in memory.
- The teacher plays a very dominating and authoritarian role while instructing
- The evaluation system mainly includes Oral, Written and easy type-examination as well organized and is simple in nature so that it can be acquired through rote learning.
- The role of the teacher is prominent (Primary \& active) and that of the student is secondary (Secondary \& Passive).
- Memory level teaching does not improve intelligence and increase student's capability but this is required for other types of teaching levels.
The Herbartian theory of apperception supports that the young children's mind is ready for perceiving themselves and the world around. Their mind is ready for a great mass of factual information including concepts, elements, structures, models and theories. They can acquire and retain information about a large number of things, objects, and material through memorization.


## Classification of memory:

> Immediate memory: when a recall is immediate
$>$ Permanent memory: the recalling of material for a longer time.
> Personal memory: while recalling past experiences, we remember our personal past experience.
> Impersonal memory: recalling from books, and companion.
$>$ Active memory: make effort to recall past experiences, recalling answers in exams.
> Passive memory: recall past experience without effort.
> Mechanical memory or physical memory: body becoming habitual of doing any task repeatedly.
$>$ Rote memory: cramming facts without understanding.
$>$ Logical memory: to learn something by using intellect and it's recalling when needed.

## Important Points on Understanding level of teaching (ULT) as proposed by Morrison.

It is 'memory plus insight. It makes understand the principles and facts.
$>$ Memory level teaching is the prerequisite for the understanding level of teaching as it talks about the generalization of principles, theory and other key important facts.
> This helps to build the thinking level of students to make use of their acquired knowledge on the basis of previously known facts and subjects.
$>$ The teacher explains the student about the relationship between principles and facts and teaches them how these principles can be applied.
> It focuses on mastery of the subject
> It provides more and more opportunity for the students to develop skills of 'Memory + Insight'
$>$ The evaluation system of this level is mainly objective type questions and essays.
$>$ Student and teacher both play an active role in the Understanding level of teaching
Morrison has divided the understanding level of teaching into 5 steps;

- Exploration: testing previous knowledge, analyzing the content.
> Presentation: content is presented, diagnosis, and recapitulation till the students understand.
> Assimilation: generalization, individual activities, working in laboratory and library, the test of content.
$>$ Organization: pupils are provided with the occasions for representation.
$>$ Recitation: The pupil presents the content orally.


## Important Points on Reflective level of teaching (RLT) as proposed by Hunt.

Reflecting on something means giving careful thought to something over a period of time. It also means thinking deeply about something. It is problem centric approach.

Solve problems of their lives by reasoning, logic and imagination.
> It talks about both 'Understanding level' \& 'Memory Level' teaching and it's problemcentered.
> Its main objective to develop problem-solving, critical and constructive, independent, original thinking.
$>$ At this level, the emphasis is laid on identifying the problem, defining it and finding a solution to it. The student's original thinking and creative-abilities develop at this level.
> A student is Core 'Active \& Primary' while the Teacher becomes 'Secondary \& passive' in this.
$>$ In Reflective level of teaching (RLT) Hunt is the main Proponent. It includes ULT and MLT. It is problem-centered teaching. The students are assumed to adopt some sort of research approach to solve the problem. The classroom environment is to be sufficiently 'Open and Independent'
$>$ Hunt developed the reflective model of teaching which goes through the various steps including creating a problematic situation. Formulate and verify the hypothesis, data analysis and testing the hypothesis around the problem.
> An essay type test is used to evaluate the learning process.
$>$ The teaching at this level is not teacher-centered or subject-centered, it is leaner-centered.

Learner's Characteristics: Characteristics of Adolescent and Adult learners (Academic, Social, Emotional and Cognitive) Individual Differences.

## Characteristics of Learners

A learner is someone who is consistently learning. We are the learner that some are the other time in our daily life to be precise a learner at particular time is that person Allah calligraphy who is learning about a particular subject. For a decision maker it is important to know the learners characteristics it is essential to know what factors affect the learning can be described that the process of acquiring new or modifying existing knowledge skill values behavior and preferences. Learning is strongly based on the intellectual level cognitive ability perception personality and attitude to a learner. As individual many factors the affect the learning of a person. They are bound to get influenced by the social Arena, cultural habits and willingness of a person to adopt change. No successful outcomes strategy can be expected without analyzing learner characteristics.

Learner characteristics can be identified by collecting the information based on their cognitive, psychological, effective and social characteristics. Different about such as surveys interviews observation Current Knowledge/ skill levels and performance result.

Personal characteristic can be can be defined as demographic information about the learner such as age, cultural background, natural, social economic status and specific needs of a learner group such as particular skills and disabilities for and/ or impediments to learning.

Academic characteristics of respondents including the education type education level and knowledge. The learner has social/ emotional characteristics. Cognitive characteristics of learner can be described such as memory, mental pressure, solve problems, intellectual skill, and remember organizers and store information in the brain.

## Definitions of Learning

Gardener Murphy the term learning covers every modification in behavior to meet environmental requirements."

Henry P Smith: "learning is a is the acquisition of new behavior for the strengthening and weakening of world behavior as the result of experience."

Learning means a permanent change in the behavior of the learner through experience, instructions, and stud. It is very difficult to measure the learning but the result of learning can be measured. Learn all characters sticks can be described as measuring the characteristics of learners such as behavior nature, attitudes and psychological towards everything related to learning. In learner characteristics aptitude is defined according to COMBAC and SNOW "as any characteristic of a person that forecast his probability e of success under a given Treatment" it or whatever makes a person ready to learn rapidly in a particular situation (or more generally
how to make effective use of a particular environment)" various components were described in learning characteristics such as gender, age, motor, motivation learn and.

## Learner's Characteristics:

During a learning phase, a learner faces different issues such as doubts, fear of exam, exam pattern, study material and syllabus etc. These problems can be tackled through hard work, consistent efforts and more practice. There are a few characteristics of learners given below -

1. Good Learners are Curious - Alana is never satisfied. There always hungry for information, love the discovery and try to find out the solution to problems. Collect the information about best study material and latest information which was provided by UGC.
2. Carefully understanding: a good learner Processes the attribute of careful understanding. most of the knowledge can be gained with. are are learn an effective learner always tries to to interpret the stimulus, combine and differentiate them and give them some meaning.

Learner's characteristics are divided into following categories

1. Social Personal Quality : Alone or is always willing to learn and open for information he has a broad mental space and aspects that change is consistently inquisitive nature of learn develops and urge in them for acquiring more and more knowledge from their parents, siblings, ne, relay, teachers society and many more.
> Interest and Attitude of Learner: There is a difference between the interest and the attitude of learner. teacher always place and important role to assess the learners for their interest and aptitude so that they can guide according to their aptitude.
$>$ Easily Adjustment to Change: All thought, it is not possible to every learn to adjust in every situation as a different learner has different characteristics of adjustment. some learners easily adapts classroom environment and some feel uncomfortable in the class environment. so a good learner should adjust according to the situation.
> Internal Motivation: Motivation is an important factor for a love note to achieve their goals. Learners differ in their capacity of motivation. some learners are easily motivated while some hesitation for a long time before they get motivated by their instructors.
2. Social Cultural Background: Learners come from, area and family background. this love perform in. Learn take some time to adjust the class and one or maintain the doped. it is very difficult for learn to adopt, and understand and in the beginning.
> Learning Power: Some learners very quickly understand the questions and solve the problems. if song easily, it means that understanding level of a learner is high as compared to another person who takes the more time to understand the and solve the problems.
$>$ Nervousness: Nervousness is the natural attribute and of learners if the learn of his nervousness, it means that they have lack of knowledge and the things. it can be removed with the help of teaching learning process.
> Application of Mind and Creativity : All have the different approach to to their lives. most of the learner accept what is thought to them but there are have many creative abilities. they have the ability to explore the things and think innovations. Moreover, application of mind is necessary to remain a head. in society different person have the different profession such as doctor, scientist, innovators and discovers are from the categories of learner who are creative.

A few other important outcomes of learning are also
> Learning is a blend of new or old Elena.
> It helpful to develop learner as well as society.
$>$ It hence is the purpose full ability of learners.
> It helps the learner in adjusting to his environment.
$>$ IT results in a change in behavior of the learner.
$>$ Learning is the product of heredity and environment.
> A good learner can adjust his/herself according to the situation and achieve their objective objectives.
In the 21 st century, digital sources also act as a significant learning platform. Effectively coordinating along with the group of learner characteristics, provides learners to enjoy high quality of life and make a good relationship with Resilient, International, creative and confident. a good learner can understand the value of teamwork, the relationship of effort two output and at the same time, nose the need to be e regularly learning and growing.

## 3. Types of Learners and Teaching Methods (NT)

## A Child- Pedagogy. (Step by Step)

Pedagogy Model - Pedagogy is a term that refers to the method of how teachers teach in theory and in practice. Pedagogy is formed by an educator teaching beliefs and concerns the interplay between culture and different ways to learn in order to help students to build on previous knowledge meaningful classroom relationship must exist. Pedagogy refers to the study of teaching approaches and how their affect learners. are carefully considered pedagogies essential in enabling students to learn more effectively and can help them developed higher order thinking skills.

## There are four common forms of pedagogy.

1. Social: Education as supporting social development.
2. Critical: Deconstructing normative perspectives.
3. Culturally Responsive: encouraging the sharing of diverse backgrounds and experiences.
4. Socratic: Developing Intellectual and Social Skills to live in Democratic Society.

## Characteristics of Pedagogy :

1. Trainer - led learning.
2. The learner is dependent.
3. Teachers determiners what and how to learn.
4. Learners take no responsibility for their learning.
5. Motivation Drives from External Sources.
6. Adolescents - Andragogy. (Guidance) self directed and goal- driven learning. it uses role plays. stimulation and self evaluation as strategies. The learners are independent and problem solvers. Learners seek guidance for the direction of their learning. Motivation is intrinsic.
7. Heutagogy Model - (Self Learning) Self- determined learning. The learners know their destination are problem finders. Learners accept full responsibility for their learning.Learners are inquiry- driven. Motivation lies in experiencing flow and knowing how to learn.

## Theories:

1. Gardner: Theory of Multiple Intelligence (1985)
> Musical.
$>$ Visual. (drawing)
$>$ Verbal.
> Logical, Mathematical.
> Body, sports. Dance etc
$>$ Interpersonal, (Social Activities)
> Intrapersonal, (Who Intuitive).
2. John Dewey : Cooperative Learning Theory:
3. Lev Vygotsky : Zone of Proximal- Development ZPD (learner can do with Guidance)

## Behaviorism :

1. Ivan Pavlov: (Psychological approach) Classical conditioning.
2. BF Skinner: Operant conditioning, Positively Reinforcement (Prize) Negatively Reinforcement (Punishment).

## The factors which are effect in the teaching learning environment:

It's well known fact and based on various study to exam in the direct and indirect effects of factors affecting the learning process or teaching significant evidence was provided that the learning process and teaching is is affected both by direct and indirect variable. Not only this teaching process also gets impacted based on individuals characteristics of learning and teacher along with the environmental factors that influence their integration in the classroom. Learning is the one of the most important factor that brings changes in behavior of a learner... but there is some factor which influences the acquisition of knowledge provided by teachers.

## These Factors are Broadly Divided into Three Areas

1. Learner psychological/ individual characteristic.
2. Teachers and classroom support.
3. Environment and other surrounding factors.

## Factors Affecting Teaching:

Teacher- It is not an exaggeration to say that a great teacher can change a student's life. As some of the most influential role models for developing students, teachers are responsible for more than just academic enrichment. If you want to be a great educator, you must connect with your pupils and reach them on multiple levels, because the best teachers are committed to their students' well-being both inside and outside the classroom.

Inspiring students is integral to ensuring their success and encouraging them to fulfil their potential. Students who are inspired by their teachers can accomplish amazing things, and that motivation almost always stays with them. Inspiration can also take many forms, from helping a pupil through the academic year and their short- term goals, to guiding them towards their future career. Years after graduation , many working professionals will still cite a particular teacher as the one who fostered their love of what they currently do and attribute their accomplishments to that educator. A teachers plays an important role in the teaching learning process as facilitator of learning. by adopting the best teaching techniques and efficient methods it could explode the right talent of the learners to help them towards quality learning process.

It Depends on the Various Factors of Teacher-

1. Educational Qualification: learning of different subjects and area can provide highly valued instruction which can affect that one who with only general degree. if you compare the teacher who has M.Ed or PHD you will be able to identify the the different ways of thinking and imparting knowledge to students.
2. Skills: "teaching talent is different psychology. One who has higher degree can't touch your has right instinct and can teach in better way than others. Teaching skill is all about you connect with students; it depends on the method of teaching you apply, you are way of explanation and engagement with student in the classroom. Teacher need to have mastery of following skill-
a. Communication skills for better environment and engagement.
b. Use of teaching aids effectively.
c. Selection of teaching method appropriate.
d. Passion for teaching.
e. Human relations skills to act as best guide or mentor.
3. Experience: it's well known fact that it is easy to become teacher after full feeling full feeling the criteria but they actually become' mass' Xperia. hi qualification Mein give teachers yet in terms of understanding that different topics or Complex formula but it is the experience in the classroom which helps you to learn and employee better methods to affect learning of students. This is also required to handle different mindset of different students in the classroom.
4. Subject Matter: Many time teachers have been assigned the subject in which he is not specialised and he himself not in better position to help learners in effective way... so the passion towards the subject and Ud and SM is also key factor that impact learning of students for example, this is very rare chance that our teacher can give good learning experience in subjects related to science.
5. Learn: Learning is the most effective when the differences in learners language, cultural and social behavior sari taken into account, it is necessary to take note of Intelligence, ethnic group, race, belief and socioeconomic status of the learners which can influence that teaching in the classroom. every individual is different with others in the terms of physical, social and cultural orientation: these aspects makes learn a different from one another.

## Environment and other factors:

1. Supporting Materials: Teacher support system is set of tools that will improve students achievement by improving the capacity of teachers. Different teaching aid and support system influences the way decisions are made and information is passed to students. It helped to analyze the area in which students are underperforming. This also so help stitches to game new skill to increase student learning by use of effective strategies. This is vast area which included many subsection to be worked upon by teacher to improve overall learning process through effective use of tools, assessment methods and professional development.

- Student assessment science course
- Teaching Strategies and lesson plans.
- Standards and benchmark
- Effective use of traditional, modern and ICT based tools.


## 2. Instructional Facilities:

> Teaching Aids- Teaching aids and integral component in any classroom. the many benefits of teaching aids include helping learners improve reading comprehension skills illest illustrating for reinforcing muscular concept, differentiating instruction and relieving anxiety are boredom by presenting information in a new and exciting way.

## > Learning Environment:

> Classroom Environment- Classroom environment plays important role in learning process and it affects both teacher and learner.
$>$ While this is to be maintained by both by teacher and students.
$>$ For active participation in education, concentration of students is required.
$>$ Teacher need to focus of behaviour of students along with the other factors to improve the classroom environment so that students listen teacher's voice while interacting with students.
$>$ Socio Economic Factor- Economic and social background of teacher and students also affect learning curve. it has direct and indirect effects on thinking level of students and teachers both. Where is a study of teaching has pointed poor and rich student classify economically and this factor has influence on their learning speed. on other side if teacher is less paid in terms of salary this also impact his thinking level and ways of teaching in the classroom.
> Expectations- Every parents have some sort of expectation with his word in terms of what and where they want to see their children, this has psychological impact on students causing stress and impairments. it often seen that if a student is not able to perform mentally it create depression and sometime leads to life a new. that's the reason parents involvement in the learning process is important to ease out burden on students and helping them to improve learning as overall.

## 4. Institution:

$>$ Teacher is abiding by administrative policy of the institution affecting the learning processes.
$>$ There are chances that teacher want to deliver in a way he loves to do but the institute policy don't allow him to use his own method.
$>$ This leads to dissatisfaction in teacher causing learning process to slow down.
> It should not be the case that teacher should download the way they want but effective planning of lesson and consultation to improve learning path is required in line with the institute policy.
$>$ NCERT(National Council of educational research and training in its Publication to teaching skills 91982) as laid stress on the following teaching skills :

- Writing instruction objectives.
- Organizing the country. the content.
- Creating set for introducing the lesson.
- Structure.
- Question delivery and its distribution.
- Race management.
- Explain.
- ileus illustrate.
- Used.
- Stimulus.
- Spacing of the lesson.
- Pacing of the lesson.
- Promoting Pupil participation.
- Use of blackboard.
- Achieving closure of the lesson.
- Giving assignments.
- Evaluating the People's progress.
- Diagnosing Pupil learning difficulties and taking remedial measures.
- Management of the class.


## MICRO TEACHING:

Micro Teaching is a product of research at Stanford University. It was first adopted in 1961 by white 8 w Island and his co-workers. It implies Micro element that systematically atoms to simplify the complexities of the teaching process. Teaching is a complex process. It cannot be mastered in a rigid and general setting. so it is analyzed into well-defined components that can be practiced, taught and evaluated. Micro Teaching concentrates on specific teaching behaviour and provides opportunity for practicing teaching under controlled conditions. so through micro
teaching, the behaviour of the teacher and Pupil is modified and the teaching learning process is more effective by the skill training.

## DIFFERENT TYPES OF TEACHING METHODS

$>$ Teaching and learning are the two sides of a coin. The most accepted criterion for measuring good teaching is the amount of student learning that occurs. There are consistently high correlations between students' ratings of the "amount learned" in the course and their overall ratings of the teacher and the course
> Those who learned more gave their teachers higher ratings (Cohen, 1981; Theall and Franklin, 2001).
$>$ "Tell me, I forget. Show me, I remember. Involve me, I understand."
$>$ There are different types of teaching methods which can be categorized into four broad types

1. Teacher- centered methods.
2. Learner- centered methods.
3. Content-focused methods.
4. Interactive/participative methods.
$>$ Here the teacher casts himself/herself in the role of being a master of the subject matter. The teacher is looked upon by the learners as an expert or an authority. Learners, on the other hand, are presumed to be passive and copious recipients of knowledge from the teacher.
$>$ Examples of such methods are expository or lecture methods - which require little or no involvement of learners in the teaching process. It is also for this lack of involvement of the learners in what they are taught, that such methods are called "closedended".

## Learner-Centered Methods:

> In learner-centered methods, the teacher/instructor is both a teacher and a learner at the same time. In the words of Lawrence Stenhouse, the teacher plays a dual role as a learner as well "so that in his classroom extends rather than constricts his intellectual horizons".
$>$ The teacher also learns new things every day which he/she didn't know in the process of teaching. The teacher "becomes a resource rather than an authority". Examples of learnercentred methods are discussion method, discovery or inquiry-based approach and the Hill's model of learning through discussion (LTD).

## Content-Focused Methods:

$>$ In this category of methods, both the teacher and the learners have to fit into the content that is taught. Generally, this means the information and skills to be taught are regarded as sacrosanct or very important.
$>$ A lot of emphases is laid on the clarity and careful analyses of content. Both the teacher and the learners cannot alter or become critical of anything to do with the content. An example of a method which subordinates the interests of the teacher and learners to the content is the programmed learning approach.

## Interactive/Participative Methods:

$>$ This fourth category borrows a bit from the three other methods without necessarily laying emphasis unduly on either the learner, content or teacher. These methods are driven by the situational analysis of what is the most appropriate thing for us to learn/do now given the situation of learners and the teacher.
$>$ They require a participatory understanding of varied domains and factors
$>$ THE LECTURE METHOD: A formal or semi-formal discourse in which the instructor presents a series of events, facts, or principles, explores a problem or explains relationships.
$>$ It creates new ideas.
$>$ It is good for a large class.
> The teacher is experienced and has mastery on the subject, explain all points and can answer all questions raised by students.
$>$ Students can ask if they need any clarification.
$>$ Learn through listening.
> The teacher explains all the points.
$>$ Students give their input Teacher discusses the whole topic in the class in easy language students can easily understand the topic.
$>$ It is good for a large class.
$>$ The teacher provides all knowledge related to the topic. Time-saving as a teacher is supposed to finish the lecture on time.
$>$ Students give their views at the end of the lecture. Students can ask the question if they have any problem to understand the lecture.
> Students attentively listen to a lecture and take notes as the teacher ask questions at the end of the lecture.
$>$ Students know and understand basic concepts.
$>$ The teacher knows all the students so he/she can use suitable strategies for the class to make them understand.
$>$ The teacher is experienced and has mastery on a subject and can answer all questions by students.
$>$ Teacher share information with students so it creates interest in students.
$>$ Students are more involved and participate when teacher ask the question.
> The teacher provides notes.
$>$ Students easily understand every point.
$>$ Students share knowledge with the teacher. The teacher is a role model for students.

## USES:

$>$ To orient students.
$>$ To introduce a subject.
$>$ To give directions on procedures.
> To present basic material. To introduce a demonstration, discussion, or performance.
> To illustrate the application of rules, principles, or concepts.
$>$ To review, clarify, emphasise or summarise.
$>$ Saves time.
> Permits flexibility.
> Requires less rigid space requirement.
$>$ Permits adaptability. Permits versatility.
$>$ Permits better centre over contact and sequence.

## THE DISCUSSION METHOD:

$>$ A method in which group discussion techniques are used to reach instructional objectives.
> Students listen to other's opinion \& express their opinion.
$>$ Discuss with teachers the points that were missed during the discussion.
$>$ Students learn on their own \& find out key points.
$>$ Students exchange their ideas.
> Students get point of view of all and not only those who always speak.
$>$ After discussion when students give their presentation, the teacher corrects their mistakes.
> Students can make their own notes.

The learning is more effective.
$>$ They don't have to rely on rote learning.
$>$ Develops creativity among students.
$>$ It evokes thinking among students.
> Students have time for preparation of topic. Students should have material and knowledge before the discussion. Suggestion Only those students participate who have confidence rest do not participate. Concepts become clear after discussion.
$>$ Every student gives his/ her opinion.

## USES

> To develop imaginative solutions to problems. To stimulate thinking and interest and to secure student participation.
$>$ To emphasise main teaching points.
> To supplement lectures, reading \& laboratory exercises.
$>$ To determine how well the student understands concepts and principles.
$>$ To prepare students for application of the theory of procedure.
$>$ To summaries, clarify points or review.

## ADVANTAGES

$>$ Increase students interest Increases students' acceptance and commitments.
$>$ Utilizes student knowledge and experience.
$>$ Results in more permanent learning because of the high degree of student participation.

## DISADVANTAGES

> Require highly skilled instructor.
$>$ Requires preparation by the student.
$>$ Limits content.
> Consumes time.

## THE PROGRAMMED INSTRUCTION METHOD (A method of self-instruction)

$>$ To provide remedial instruction.
> To provide make-up instruction for late arrivals, absentees, or translents.
> To maintain previously learned skills which are not performed frequently enough.
$>$ To provide retraining on equipment and procedures which have become obsolete?
$>$ To upgrade production. To accelerate capable students. To provide enough common background among students.
> To provide the review and practice of knowledge and skills.

## USES / ADVANTAGES

$>$ Reduce failure rate.
$>$ Improves end-of-course proficiency.
> Saves time.
$>$ Provides for self-instruction.

## DISADVANTAGES

$>$ Require local or commercial preparation.
$>$ Requires lengthy programmer training.
> Increases expenses.
> Requires considerable lead time.

## THE STUDY ASSIGNMENT METHOD

A method in which the instructor assigns reading to books, periodicals, project or research papers or exercises for the practice. To orient students to a topic prior to classroom or Laboratory work. It enhances the ability of research on any topic as the student's search topic from different books, websites etc. Active learning To set the stage for a lecture demonstration or discussion. To provide for or capitalize on individual differences in ability, background, or experience through differentiated assignments. To provide for the review of material covered in class or to give practice. To provide enrichment material.

## USES / ADVANTAGES :

$>$ Increase coverage of material.
$>$ Reduce classroom time.
> Permits individual attention.

## DISADVANTAGES :

> Require careful planning and follow up.
$>$ Poses an evaluation problem.
> Produce non-standard results.

## THE TUTORIAL METHOD

A method of instruction in which an instructor works directly with an individual student.To reach highly complicated skills operations or operations involving danger or expensive equipment. To provide individualized remedial assistance

## USES / ADVANTAGES

> Permits adaptive instruction.
> Stimulates active participation.
> Promotes safety.

## DISADVANTAGES :

$>$ Requires a highly competent instructor.
> Demands time and money.

## THE SEMINAR METHOD

A tutorial arrangement involving the instructor and groups, rather than instructor and individual. To provide general guidance for a group working on an advanced study or research project. To exchange information on techniques and approaches being explored by members of a study or research group. To develop new and imaginative solutions to problems under study by the group.

## USES / ADVANTAGES:

> Provides motivation and report.
> Stimulates active participation.
$>$ Permits adaptive instruction.

## DISADVANTAGES:

> Requires a highly competent instructor.
$>$ Poses evaluation problems.
$>$ Is more costly than most other methods.

## THE DEMONSTRATION METHOD

A method of instruction where the instructor by actually performing an operation or doing a job shows the students what to do, how to do it, and through explanations brings out why, where, and when it is done.
> To teach manipulative operations or procedures.
$>$ To teach troubleshooting.
$>$ To illustrate principles.
$>$ To teach operation or functioning of equipment.
$>$ To teach teamwork.
> To set standards of workmanship.
$>$ To teach safety procedures.

## USES / ADVANTAGES :

> Minimize damage and waste.
$>$ Saves time can be presented to large groups.
$>$ Enable learning evaluation.
$>$ Require careful preparation and rehearsal.
$>$ Requires special classroom arrangements.
$>$ Requires tools and equipment.
$>$ Requires more instructors.

## Brainstorming (Small Group Discussion):

$>$ More interesting.
> More informative Gain knowledge Learning is effective .
$>$ More participation of students Students give their opinion.
$>$ Active learning Creative thinking is encouraged.
> Students think beyond their knowledge.
$>$ Everyone gets the chance to express their thoughts.
$>$ Simple topics can be learnt from different angles.

## Roleplay:

$>$ Interesting method Creative thinking is encouraged.
> Students think beyond their knowledge. Students enjoy the situation Active learning Easy to learn

## Case Study

$>$ Active learning.
> Creative thinking is encouraged.
$>$ Students think beyond their knowledge.

## Differences Between Online Learning and Offline Learning

The main difference between online and offline learning is location. With offline learning, participants are required to travel to the training location, typically a lecture hall, college or classroom. With online learning, on the other hand, the training can be conducted from practically anywhere in the world.
> Participants simply need to $\log$ on to the internet from their home, work or even their local coffee shop.
$>$ Another difference is the flexibility offered. Online learning usually has a more flexible timescale. As a trainer, you can offer your support via email or through an online chat system. With offline learning, it is typically carried out between office hours and doesn't offer as much flexibility to the learner or the trainer.

## SWAYAM:

Study Webs of Active Learning for Young Aspiring Minds(SWAYAM) SWAYAM is an indigenous (Made in India) IT Massive Open Online Courses (MOOCs) Platform for providing best quality education that can be accessed by anyone, anytime and anywhere using the IT system.

The Concept of Massive Open Online Courses (MOOCs) involves online delivery of interactive learning content to large number of people simultaneously. It allows sharing of best quality education with everyone, thereby bringing in equity as far as the quality of education is concerned.

SWAYAM platform is developed by Ministry of Human Resource Development (MHRD) and All India Council for Technical Education (AICTE) with the help of Microsoft .

Its ultimately capable of hosting 2000 courses and 80000 hours of learning: covering school, under-graduate, post-graduate, engineering, law and other professional courses.

All the courses on this platform are interactive, prepared by the best teachers in the country and are available, free of cost to the students in India.

More than 1,000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.
[Official Swayam website - https://swayam.gov.in/ ]

## There are 4 quadrants in the MOOC pedagogy

Video tutorials covering a whole course - normally having about 20 hours of instruction in series of lectures, each lecture not exceeding 30 minutes. E-Content: reading material that could add to the learning imparted through the video tutorials. Self-Assessment: Quizzes/assignments that intersperse the course Discussion forum for posting queries All the courses delivered through

SWAYAM are available free of cost to the learners, however students wanting certifications shall be registered, shall be offered a certificate on successful completion of the course, with a little fee.

## SWAYAM Prabha: the 32 Educational DTH Channels

The SWAYAM PRABHA is a group of 32 DTH channels devoted to telecasting of highquality educational programmes on 24X7 basis using the GSAT-15 satellite. Every day, there will be new content for at least (4) hours which would be repeated 5 more times in a day, allowing the students to choose the time of their convenience. The channels are uplinked from BISAG, Gandhinagar. The contents are provided by NPTEL, IITs, UGC, CEC, IGNOU, NCERT and NIOS. The INFLIBNET Centre maintains the web portal. Teaching Support System: Traditional, Modern and ICT based (NT). The rapid growth of Information and Communication Technologies (ICT) has challenged the traditional method of teaching and changed the educational landscape globally. The teaching method is now divided into two different ways of thinking on education, one is traditional and other one is ICT Method. Most of the teachers and experts have explored new methods of teaching and believe that modern methods or the ICT method is better than the traditional method of teaching.

When we talk about teaching methods then our society divides into three groups; one group favors the traditional teaching methods, second group favors modern teaching methods and third group is the one who supports the combination of both for effective teaching.

## Traditional teaching methods and support system:

Traditional education, also known as back-to- basics, conventional education or customary education, refers to long-established customs that society traditionally used in schools. The back-to-basics traditional education method, also known as 'chalk \& talk method' This old fashioned way of teaching was all about the recitation and memorization techniques. The traditional role of teaching focuses on the teacher as organizers of learning activity,
$>$ Providers of information and experts of knowledge.
The teacher carries too much of responsibility for teaching in the classroom to make sure everything they are teaching is understood by the students. Teacher is also responsible to control class where the teacher teaches using blackboard, explains concepts, asks students to copy and makes sure that students are paying attention. This technique of teaching is a one-way flow of information in which the teacher often continuously talks for an hour or more expecting that when he asks a question, the students will able to reproduce the same thing that he was talking about.
$>$ Providers of information and experts of knowledge.
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#### Abstract

everything they are teaching is understood by the students. Teacher is also responsible to


 control class where the teacher teaches using blackboard, explains concepts, asks students to copy and makes sure that students are paying attention. This technique of teaching is a one-way flow of information in which the teacher often continuously talks for an hour or more expecting that when he asks a question, the students will able to reproduce the same thing that he was talking about. Every important thing regarding the topic is written on the blackboard and students make important notes from the blackboard. After the lecture is over students revise their notes and try to memories the notes. Instruction based on textbooks, lectures and individual written assignments. The main objective of traditional teaching is to pass the examination.
## Merits and Demerits of Traditional Teaching Methods :

Traditional methods of teaching that are still being adhered to in the schools; It has more interaction between the teacher and student. Traditional teaching systems help to build the discipline in the class room. Lack of collaboration and group learning. More emphasis on examinations and results rather than understanding of concepts.

## Tools used in Traditional Teaching Support System:

$>$ Blackboard.
$>$ Textbooks.
$>$ Charts Images \& posters.
$>$ Maps \& atlas, globes Flash cards, flip cards Science lab apparatus,
$>$ models Workbook Drawing books Dictionary, encyclopedias
> Vedic math tools Puzzle books,
> General knowledge books

## Modern and ICT Based teaching methods

Gone are the days of blackboard and chalk ...it all replaced by LCD Projectors \& interactive whiteboards in the classroom. When we talk about the modern or ICT based education system its include full fledged usages of high tech equipment in the educational institutions. Information and Communication Technology (ICT) in education is the mode of education that use information and communications technology to support, enhance, and optimize the delivery of information.

## The DTH Channels cover

Curriculum based course contents covering diverse disciplines such as arts, science, commerce, performing arts, social sciences and humanities subjects, engineering, technology, law, medicine, agriculture etc. in higher education domain (all courses would be certification-
ready in their detailed offering). School education (9-12 levels) modules; for teacher training as well as teaching and learning aids to children of India to help them understand the subjects better and also help them in better preparedness for competitive examinations for admissions to professional degree programmes. Curricula and courses that can meet the needs of life-long learners or Indian citizens in India and abroad.
$>$ IIT-PAL - to assist the students in the Classes $\mathbf{1 1}$ and $\mathbf{1 2}$ aspiring to join IITs by encouraging scientific thinking and conceptual understanding critical to answer the 'tough' questions of JEE Advanced, so that good quality students enter the portals of IITs. The four channels under this would be on Mathematics, Physics, Chemistry and Biology.
> MHRD, is responsible for the overall development of the basic infrastructure of Higher Education sector, both in terms of policy and planning. You can read more about - Digital Initiative in Higher Education Through NMEICT

## Evaluation System

Evaluation is a systematic process of collecting, analyzing and interpreting of students progress and achievement both cognitive and non- cognitive areas of learning for the purpose of taking a variety of decisions. The evaluation process ascertains the workability of learning experience and change of behaviour of the students. The term evaluation is both qualitative and quantitative process.

## Functions of Evaluation:

There are three main functions of evaluation:

1. Evaluation of the learning system.
2. Measurement of learning outcomes.
3. Management of learning objectives.

## Nature of Evaluation:

1. It is humane in nature. It helps students grow as social beings and thus save them from unnecessary pain, anxiety, harassment and humiliation.
2. It is the responsibility of the teacher who teaches the students and is responsible for developing the requisite healthy attributes in them.
3. it will reflect the outcomes of each learning intervention and would provide all the students the same opportunity to display their individual potential.

## Evaluation techniques:

All techniques of evaluation can be broadly classified into two categories:

1. Quantitative techniques:
A) Oral techniques.(highly reliable and valid)
B) Written techniques.(objective and essay)
2. Practical techniques. (assess the skill or psychomotor objectives) (used in science. Geography, home science, agriculture etc)
3. Qualitative techniques:
A. Cumulative Record.
4. Anecdotal Records. (description of significant event and work or performance of the students)

## Observation Technique.

Checklist. (it is used for evaluating interest, attitudes and values of the students.)
Rating scale: (feed back)

## Evaluation Methods:

$>$ Formative assessment regular - Weekly test
$>$ Summative assessment - Final exam
$>$ Norm Referred \& Criterion referred - judge individual
> CCE - Continuous Comprehensive Evaluation

## Choice Based Credit System in Higher Education

$>$ In Indian educational system, evaluation plays a vital role between teaching and learning process. It completes several system of education like the quality control in the education system, in selection or entrance for higher grades.
$>$ In the words of Kothari Commission," Evaluation is a continuous process, forms an integral part of the total system of education and is intimately related to educational objectives. It exercises a great influence of the pupil's study habits and the teacher's methods of instruction and thus helps not only to measure educational achievement but also to improve it. The techniques of evaluation are means of collection evidence about the student's development in desirable directions."
$>$ The Ministry of Human Resource and Development of India are in the process for New Educational Policies to develop and reform the educational system of our country. Several steps are being taken to improve the excellence, efficiency for the Higher Education System like change in the curriculum, change in the education system, etc.
> In most institutes for higher education, Semester system or percentage based evaluation system are being followed.
> There's a lot of buzz in introducing the Choice Based Credit System (CBCS) in higher education for evaluation purpose.
$>$ The CBCS opens up many opportunities and path for the students to learn and explore not only the subject of their choice but beyond which also develops ones individual self. These courses can further be evaluated through grading system, which is considered to be better than the age old marking system. It is better if we introduce and follow the uniform grading system across India which will further help the students to move across institutions within India and across countries.
$>$ Not only it will help the students but also the potential employers to assess the performance of the candidates uniformly through evaluation system and Cumulative Grade Point Average (CGPA) based on the student's performance in the examination.

## The structure and implementation of Choice Based Credit System (CBCS).

The approach should be student centric. That is, the CBCS system will permit the students to choose their choice of courses like inter or intra disciplinary courses, skill based courses, etc. It gives relaxation to students to take up the course even they are from different disciplines like a student can combine Physics with Economics likewise. The student has the freedom to complete their course from different institutions at different period of time. It can also transfer the points or the credit which the student gets from one institute to other. Hence, if the CBCS system gets implemented it will be good for a student as it provides flexibility and also meet their requirement. The students get the privilege to choose the subjects of their choice. They are being classified as different groups which allow the students to choose their choice of subjects from each group.

## (UGC) categorized course details

$>$ Core Course - In core course, the student have to compulsory study the core or the main subject to fulfill the requirement of the programe of that particular discipline which he/she is studying. Core courses will be there in every semester.
$>$ Elective Course - In elective course, the student can choose any paper of his/her choice. It could be : Discipline Specific Elective Course like it will support the discipline of study with the main subject. It could provide an extended scope for the student to study further. It also gives the student the exposure to some other areas. It also nurtures the student's proficiency/skill on any particular subject.
$>$ Generic Elective
$>$ Project
$>$ Ability Enhancement Courses
> Skill Enhancement Course

## Foundation Course:

> There are two types of Foundation courses - Compulsory Foundation and Elective Foundation. Compulsory Foundation course are content based which leads a student for their knowledge improvement. They are compulsory for all disciplines.
$>$ Elective Foundation course are based upon values which aims at man making education.
$>$ UGC recommends Letter Grades and Grade Point Systems to be applied in giving the grades under the CBCS System.
> Letter Grades - It is based upon the allocation of marks which a student gets from his/ her course and grades are given basis upon their marks or percentage.
$>$ Grade Point Systems - Here the marks are converted into grades based upon the fixed period.
> Grade and Grade Points
> Letter Grade Letter Grade
> O (Outstanding) 10
$>\mathrm{A}+($ Excellent $) 9$
> A (Very Good) 8
$>\mathrm{B}+(\mathrm{Good}) 7$
$>$ B (Above Average) 6
$>\mathrm{C}$ (Average) 5
$>\mathrm{P}$ (Pass) 4
$>\mathrm{F}$ (Fail) 0
> Ab (Absent) 0
$>$ When there are large number of students CBCS system has to be implemented with online system to meet the requirements effectively.
> It will help the students to choose the subjects and teachers of their choice. But, there should also be restriction that if a student fits into the eligibility criteria of the institution then only they can choose the subjects of their choice.
> Through online system, the teachers would also be able to share their notes, discuss the subjects with their students, take tests, etc.
> The online system should be user friendly and easy for the teachers. It should also be able to print the mark sheets as per the institutions requirements.
$>$ After the selection of the subjects by the students a time table could be generated which would help the students and the teachers to be aware of their class and subjects.
$>$ The online system also helps the teachers in taking attendance of their subjects for each student.
> It will decrease the work load in maintaining the register and would be easy to calculate the percentage for each student.
$>$ The system should be able to generate report as and when required.
$>$ It should be programmed as per the institutions requirements like report for student's performance, subject wise report, attendance report, etc.
> The system should be able to store past records and data so that it could be easily accessible as and when required.
$>$ It would also help the institution to evaluate and improve the effectiveness of its system in future.

## Computation of SGPA and CGPA:

UGC recommends Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). We can calculate the SGPA in the following manner:
$>$ It is the ratio of the sum of the product of the number of credits with the grade points which a student scored and the sum of the number of credits of all the courses which a student has undergone, ie
$>\operatorname{SGPA}(\mathrm{Si})=(\mathrm{Cix} \mathrm{Gi}) / \mathrm{Ci}$
$>$ The CGPA is calculated taking into consideration of all the courses a student undergoes of all the semesters of the programe, ie
$>\operatorname{SGPA}(\mathrm{Si})=(\mathrm{CixGi}) / \mathrm{Ci}$
$>$ The CGPA is calculated taking into consideration of all the courses a student undergoes of all the semesters of the programe, ie
$>\operatorname{CGPA}(\mathrm{Ci})=(\mathrm{Cix} \mathrm{Si}) / \mathrm{Ci}$
> Abreviations:
$>$ Si-SGPA of the semester Ci-Total number of credits in that semester Gi-Grade point scored by the student in the course The SGPA and CGPA shall be rounded off to 2 decimal points which come out the result of the student.

## UNIT - 2

## RESEARCH APTITUDE

- Research: Meaning, Types and Characteristics, Positivism and Post positivism approach to Research.
- Methods of research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.
- Steps of Research
- Thesis and Article Writing: Format and styles of Referencing.
- Application in ICT Research
- Research Ethics.

Research: Meaning, Types, and Characteristics, Positivism and Postpositivistic approach to research.

## What is Research?

The term, itself, suggests that we are searching "Something" which is there but remains unknown to us. Research stands for Re meaning "again" and search "to find". So, Research means to find out something new in the topic that already existed.
> It is a quest taken for finding new information about the things we already know.
$>$ It is a scientific enquiry and has to be systematic, for searching important information on a specific topic.
$>$ It can also be referred to as a 'voyage of discovery'. By and large, it is an academic activity but has implications for real-life situations such as policymaking.
So, we can sum up the meaning of research as:
$>$ An attitude of inquiry/search/investigation.
$>$ A scientific and objective effort made to uncover facts.
$>$ Hence, requires the application of scientific methods.

## Some important definition:

> Young PV defines it as, "Research may be defined as the systematic method of discovering new facts or verifying old facts, their sequences, interrelationships, causal explanations and the natural laws which govern them".
$>$ Kerlinger defines as, "Research is systematic, controlled, empirical and critical investigation of hypothetical propositions about the presumed relations among natural phenomenon".

## Characteristics of Research:

Some of the characteristics of research are....
$>$ It is a scientific investigation.
$>$ By scientific, we mean that it requires the use of scientific methods and procedures. That is, methods and procedures which have been tried and tested, and produce similar or somewhat similar results on each applications.
$>$ The results or information that we get through scientific methods can be used to develop concepts and theories of their own.
$>$ The findings of research may not be an immediate solution, it projects or recommends some solution sometimes.
$>$ Good research findings and reports helps in decision making. It also adds to the given stock of information or the body of existing knowledge.

## Types of research: there .....

1. Fundamental research
2. Applied research
3. Action research
4. Descriptive research
5. Analytical research
6. Quantitative Research
7. Qualitative Research
8. Conceptual Research
9. Fundamental research:-
> Also known as basic or pure research.
$>$ This kind of research helps to generate new information in a fundamental fashion.
$>$ This is generally based on the principle pf generalization. Sometimes, it can experiment in a laboratory also.
$>$ Fundamental research can take shape in two ways either in the form of a new theory or development of some existing theory.
$>$ Darwin's theory of evolution is an example of fundamental research. However the later or alternative theories given by other researchers can also be considered to be fundamental research, for it builds on the fundamental theory.

## 2. Applied Research:-

> Theories developed by fundamental research are further applied to actual operational fields or population.
$>$ Applied research is useful because it provides convincing evidence to the usefulness of basic research or theory.
$>$ It aims at collection of data verifying existing theories and models.
> It helps to find a solution for real-life problems or situations. Adding to knowledge is not the only aim.
> Marketing and medical research are examples of applied research.

## 3. Action research:-

$>$ As the name suggests, this kind of research is oriented.
> It is undertaken to find an immediate solution to a problem.
> Testing the purity of water in an area and taking necessary steps, thereof to improve the quality of water can be the example of action research.

## 4. Descriptive Research:-

$>$ It is description of the state of affairs as they are in their own right. This means the researcher has no control over the variables.
> Some of the methods used for descriptive research are field surveys, case studies and interviews.
> Some also use the term ex-post facto research for this kind of research, especially in the case of business and social science research.
$>$ A qualitative study undertaken to learn about the preference of people to use toilets in rural India can be an example of descriptive research.

## 5. Analytical Research:-

This is based on the use of information already available to the researcher and making an analysis using logic and reasoning.
> This is usually an in depth study. This works under a constrained set of variables.
$>$ This requires the use of critical thinking and evaluation.
$>$ A study conducted to find the reasons for the decline of a currency value can be the example of analytical research.

## 6. Quantitative Research:-

> Quantitative research is concerned with numbers.it is carried out to study a phenomenon that can be expressed in numbers.
$>$ Quantitative is usually deductive in nature and begins with a given theory.
$>$ Statistical concepts and software are used to carry out this kind of research.
> S study undertaken to find out the number of toilets built under swaachh bharath Mission is the example of quantitative research.

## 7. Qualitative Research:-

$>$ Qualitative research is done to study the phenomenon that can be explained beyond numbers that is in a qualitative manner.
$>$ Qualitative is usually inductive in nature and begins with a social reality followed by the construction of the theory around it.
$>$ There is statistical software to study qualitative phenomenon as well. For example, SPSS is widely used to carry out large-scale qualitative research.
$>$ A study undertaken to learn about the experiences of children with cerebral palsy can be an example of qualitative research.

## 8. Conceptual Research:-

$>$ Conceptual research is usually undertaken by philosopher or thinkers to reinterpret an existing idea. Although, some researchers use a conceptual framework to study business or market phenomenon also.
> This kind of research doesn't involve conducting experiments, it is abstract in nature
> Suppose a study finds out that the using social media over one hour a day can be linked to depression. This will be based on the conceptual framework formulated by the researcher and can be the example of conceptual research.
$>$ Other than that, theories if gravitation, evolution and motion are also conceptual ideas or research.

## POST-POSITIVIST APPROACHES TO RESEARCH

This chapter outlines the philosophical thinking behind this book. Take your time reading it and don't be put off if you encounter words and terms that are unfamiliar to you. These terms
will become clearer as you read on. The chapter outlines the background and assumptions for many of the techniques and suggestions put forward in later chapters. Without some knowledge of philosophy or context, technique can become an empty process. Philosophy provides principles that can act as a guide when procedural advice does not address a particular issue. You might like to read this chapter at the start of your thesis process, but it is also likely that you will dip into it from time to time, as certain questions arise out of the process of researching and writing the thesis.

Post-positivist research principles emphasise meaning and the creation of new knowledge, and are able to support committed social movements, that is, movements that aspire to change the world and contribute towards social justice.

## Post-positivist research has the following characteristics:

$>$ Research is broad rather than specialised - lots of different things qualify as research;
$>$ Theory and practice cannot be kept separate. We cannot afford to ignore theory for the sake of 'just the facts';
$>$ The researcher's motivations for and commitment to research are central and crucial to the enterprise (Schratz and Walker, 1995: 1, 2);
$>$ The idea that research is concerned only with correct techniques for collecting and categorising information is now inadequate (Schratz and Walker, 1995: 3).

## Positivist views of research

What enters your head when you think about research? When we discuss this question with student researchers, they usually come up with words like facts, figures, statistics, writing, evaluation, objectivity, science and logic. Traditionally it was thought that there was a single, correct set of procedures for investigating phenomena and presenting findings, based on a scientific model of research. People sometimes still think that social research should model itself on research in the natural sciences.

Public discussions (think, say, of Morning Ireland on RTÉ radio) about social research are usually set in this scientific framework. They centre on questions such as, what is the hypothesis? How big is the sample? How representative is the sample? How can you generalise if you have a small sample? Was there a control group? The validity of a piece of research is assessed by how well it meets these scientific criteria.

Using scientific method and language to investigate and write about human experience is supposed to keep the research free of the values, passions, politics and ideology of the researcher. This approach to research is called positivist, or positivist-empiricist and it is the dominant one among the general public. Positivist researchers believe that they can reach a full understanding
based on experiment and observation. Concepts and knowledge are held to be the product of straightforward experience, interpreted through rational deduction.

## The context for postivism

Each one of us lives out our lives in the context of a worldview, which influences how we think and behave and how we organise our lives, including how we approach research. But worldviews often go unarticulated or unnoticed, and we often fail to realise that the assumptions we carry about research are related to a particular worldview or mental model. We need to uncover our worldviews and subject them to scrutiny. This is especially important for those doing research. As social researchers, we work within, not outside, broader historical, social and theoretical contexts. These contexts serve as the scaffolding for the questions we ask and how we go about answering them. The bigger scaffolding that supports positivism is a modernist worldview.

## Modernism

A modernist outlook is the cumulative outcome of four foundational movements in European thought - the Renaissance, The Reformation, the Scientific Revolution and the Enlightenment (Spretnak, 1999: Chapter Two). Within modernist ways of knowing the world, only certainty and empirical knowledge are valid, and the rational is valued over other ways of knowing, such as intuition. Positivism seeks to reduce everything to abstract and universal principles, and tends to fragment human experience rather than treat it as a complex whole. (For further reading on modernity, see Goodman, 2003; Spretnak, 1999; Tovey, 2001.) Modernity led to a split between science and literature as different ways of understanding human experience. The natural science model came to dominate in social research. This became known as positivism or positivistempiricism. Positivist research places faith in quantification and on the idea that using correct techniques will provide correct answers. It is also concerned to some extent with prediction and with control.

## Positivisms

The foregoing review represents classical positivism and there are many variations of it. It is, therefore, more appropriate to think of positivisms. We should not forget that a modernist worldview has played a large part in the development of ideas concerning liberation, justice and freedom. Spaces exist within positivism for radical practice. Many Irish and international researchers have used positivist research approaches in the drive to create a more equal and just society. Setting up positivism and post-positivism in opposition to each other does not adequately represent the more messy on-the-ground realities of how research proceeds. Most studies in the natural sciences do not in fact proceed in a defined linear fashion, but are the product of weblike and cyclical thinking. The way they are written up however often makes it seem as if they
proceeded in a linear manner. Positivist visions of science do not always reflect the actual practice of doing science (cf Mishler, 1990; Kuhn, 1962).

## What has prompted a move away from positivism?

Opposition to positivist epistemologies has come from feminism, post structuralism, critical psychology, anthropology, ethnography and developments in qualitative research. Critiques of positivism are implicit in other movements for social change, as well as in the knowledge of Eastern, Asian and indigenous societies, who see all events and phenomena as interconnected. This kind of knowledge, for so long despised by the Western scientific tradition, has now been revitalised. This has come about because the movements and peoples concerned have:
$>$ Emphasised that there is no neutral knowledge;
> Shown the inadequacies of dualistic, that is, either/or, or black/white thinking;
$>$ Emphasised the ethical aspects of research.
In addition, complexity science has challenged the dominance of reductionist scientific models.

## What do post-positivist insights mean for the researcher?

## You investigate your own epistemology

Insights about the limitations of positivism and modernity imply that you have to understand your own place in the world and what you are bringing to the research by way of assumptions about knowledge. Investigating your own epistemologies and understanding how they affect you as a researcher is an essential part of the post-positivist approach. As part of this investigation, you come to some understanding of how people construct and maintain perceptions of the world. Examining your epistemology involves looking at the underlying assumptions you use to make sense of our day-to-day lives. 'You cannot claim to have no epistemology. Those who so claim have nothing but a bad epistemology' (Bateson, 1977: 13, cited in Scully, 2002: 10).

## Take up learning rather than a testing role

The post-positivist social researcher assumes a learning role rather than a testing one (cf Agar, 1988:12). One of the opportunities and challenges posed by this approach is that the researcher recognises the common humanity that connects researchers and the people who participate in research. We regard ourselves as people who conduct research among other people, learning with them, rather than conducting research on them (Cf Wolcott, 1990: 19).

## Value problem-setting rather than problem-solving

Post-positivist researchers do not see themselves as inevitably solving the problems they set out to investigate. Research can answer questions and indicate causes (problem solving), but equally, research can be about problem setting - coming up with the right questions (these may themselves lead to empirical research). This does not mean that we go off conducting research
without an idea of what is to be investigated - as Wolcott puts it (1990: 31), 'empty-headedness is not the same as open-mindedness'.

## Selecting a method

The appropriateness of quantitative or qualitative methods depends on the questions being asked or the issues being explored. One should use methods appropriate to the questions.

## Key tools of post-postivist research

In the search for meaning, which can lead to value-led social change, we wish to emphasise four main tools at the disposal of post-positivist researchers:
$>$ The concept of discourse
> The concern with power
> The value of narrative
> The need to be reflexive

## The concept of discourse

The post-positivist emphasis on meaning and the relationship between language and meaning is addressed in the concept of discourse. A discourse is a web of statements, categories and beliefs, habits and practices. Discourse is used to filter and interpret experience and the discourses available at a certain historical moment construct the ways that people can think, talk about, or respond to phenomena. Discourses 'invite' us to be human in certain ways, or to respond to others in certain ways. They produce certain assumptions (about, for example, women, men, economics, work, childcare, or money) and they provide subject positions from which people speak and act.

## Productivity discourse

A contributor to a radio discussion on childcare provision in the December 2005 budget said that parents were 'wasting time' worrying about childcare and caring for their children, when they could be 'productive in business'. The contributor, who remains unidentified, because the focus is on the discourse rather than the person who is using it, was drawing on a discourse of 'productivity'. The central premise of this discourse is that every citizen should be productive, meaning that they should do paid work. Children, retired people and others who are not in paid work are unproductive.

## The concern with power

The discourses available at a certain historical moment condition the ways that people can think or talk about, or respond to phenomena. Post-positivist research emphasises the struggle for meaning, and the construction of new meanings and knowledges. The concept of discourse
shows how the fixing of meaning is never a neutral act, but always privileges certain interests. Discourse is responsible for reality and not a mere reflection of it. Thus, the question of what discourses prevail and whose interests they serve are most important (Weedon, 1987: 11). This is not to discount the importance of material issues, economics or law, but to emphasise the equal importance of culture and discursive power. The production of knowledge is political and has real effects.

## Conclusion

This chapter has introduced the philosophical approach of the authors, which underpins the chapters that follow. Aspects of the post-positivist approach are developed throughout the book. In this chapter, we have set out some important characteristics, and outlined the context in which post-positivism has come about. You can return to this chapter and/or specific sections of it, throughout the thesis process.

## Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.

## What is Data Collection?

The process by which the researcher collects the information needed to answer the research problem.

In collecting the data, the researcher must decide:
$>$ Which data to collect
$>$ How to collect the data
$>$ Who will collect the data
$>$ When to collect the data
The selection of data collection method should be based on the this ...
$>$ The identified hypothesis or research problem
$>$ The research design
$>$ The information gathered about the variables

## Importance of data and data collection:

Data is one of the most important and vital aspect of any research studies. Researchers conducted in different fields of study can be different in methodology but every research is based on data which is analyzed and interpreted to get information. Data is the basic unit in statistical studies. Statistical information like census, population variables, health statistics and road accidents records are all developed from data.

## Data Collection techniques:

There are two sources of data collection techniques, primary data collection uses surveys, experiments or direct observations. Secondary data collection may be conducted by collecting information from a diverse source of documents or electronically stored information, census and market studies are examples of a common sources of secondary data. This is also referred to as "data minig".

## Types of Data:

## 1. Primary Data

## 2. Secondary Data

Primary Data: primary data means original data that has been collected specially for the purpose in mind. It means someone collected the data from the original source first hand. Data collected this way is called primary data.

Primary data has not been published yet and is more reliable, authentic and objective. Primary data has not been changed or altered by human beings; therefore its validity is greater than secondary data.

## Primary data collection methods are.

1. Survey method
2. Questionnaire method
3. Interview method
4. Observation method

Survey method:- survey is not commonly used method in social sciences, management, marketing and psychology to some extent. Surveys can be conducted in different methods.
Questionnaire Methods:- questionnaire is the most commonly used method in survey questionnaires are a list of questions either and open-ended or close ended for which the respondent give answers. Questionnaire can be conducted via telephone, mail, live in a public area, or in an institute, through electronic mail or through fax and other methods.
Interview method:- interview is a face to face conservation with the respondent. It is slow, expensive and they take people away from their regular jobs, but they allow in depth questioning and follow up questions.
Observations method:- observations can be done while letting the observing person know that he is being observed or without letting him know. Observations can also be made in natural settings as well as in artificially created environment.

## Advantages of primary data:

$>$ Data interpretation is better.
$>$ Targeted issues are addressed.
$>$ Efficient spending for information.
$>$ Addresses specific research issues.
$>$ Grater control
> Proprietary issues.
Disadvantages of Primary data:
$>$ High cost
> Time consuming
> Inaccurate feed backs
$>$ More number of resources is required

## Secondary data:

Secondary data is the data that has been already collected by and readily available from other sources. When we use statistical method with primary data from another purpose for our purpose we refer to it as secondary data. It means that one purposes primary data is another purposes secondary data. So that secondary data is data that is being reused. Such data are more quickly obtainable than the primary data.

These secondary data may be obtained from many sources, including literature, industry, survey, compilations from computerized databases and information systems, and computerizes or mathematical models of environmental processes.

## Published printed sources:-

There are varieties of published printed sources. Their credibility depends on many factors. For example, on the writer, publishing company and time and data when published. New sources are preferred and old sources should be avoided as new technology and researches bring new facts into light.

Books:- Books are available today on any topic that you want to research. The uses of books start before even you have selected the topic. After selection of topics books provide insight on how much work has already been done on the same topic and you can prepare your literature review. Books are secondary source but most authentic one in secondary sources.

Journal/ Periodicals:- journals and periodicals are becoming more important as far as data collection is concerned. The reason is that journals provide up to data information which at times
books cannot and secondly, journals can give information on the very specific topic on which your are researching rather talking about more general topics.
Magazines /Newspapers:- Magazines are also effective but not very reliable. Newspaper on the other hand is more reliable and in some cases the information can only be obtained from newspapers as in the case of some political studies.

## Published electronic sources:-

As internet is becoming more advance, fast and reachable to the masses: it has been seen that much information that is not available in printed form is available on internet. In the past the credibility of internet was questionable but today it is not. The reason is that in the past journals and books were seldom published on internet but today almost every journal and book is available in online. Sore are free and for others you have to pay the price.
E-journals:- e-journals are more commonly available than printed journals. Latest journals are difficult to retrieve without subscription but if your university has an e library your can view any journal, print it and those that are not available you can make an order for them.
General websites:- generally websites do not contain very reliable information so their content should be checked for the reliability before quoting from them.
Weblogs:- weblogs are also becoming common. They are actually diaries written by different people. These diaries are as reliable to use as personal written diaries.

## Collection of Primary Data

> There are several methods of collecting primary data, particularly in surveys and descriptive researches. In descriptive research, we obtain primary data either through observation or through direct communication with respondents in one form or another or through personal interviews.

## Collection of Secondary Data:

$>$ These are already available i.e. they refer to the data which have already have been collected and analyzed someone else.
> Secondary data may either be published or unpublished data. Researcher must be very careful in using secondary data, because the data available may be sometimes unsuitable.

Difference between Primary and secondary data:

| Primary data | Secondary data |
| :--- | :--- |
| Real time data | Past data |
| Sure about sources of data | Not sure about of sources of data |
| Help to give results finding | Refining the problem |
| Costly and time consuming process | Cheap and no time consuming process |
| Avoid biasness of response data | Cannot know in data biasness or not |
| More flexible | Less flexible |

## Experimental Research

## Introduction

$>$ There are various phenomena such as motivation, productivity, development and operational efficiency, which are influenced by various variables.
> It may become necessary to assess the effect of one particular variable or one set of variables on a phenomenon.
> This need has given rise to experimental research.

## Meaning

$>$ Experimental research is designed to assess the effects of particular variables on a phenomenon by keeping the other variables constant or controlled.
$>$ It aims at determining whether and in what manner variables are related to each other.
$>$ The factor, which is influenced by other factors, is called a dependent variable, and the other factors, which influence it, are known as independent variables.
$>$ For example, agricultural productivity, i.e. crop yield per hectare is a dependent variable and the factors such as soil fertility, irrigation, quality of speed, manuring and cultural practices which influence the yield are independent variables.
> The nature of relationship between independent variables and dependent variables is perceived and stated in the form of causal hypothesis.
$>$ A closely controlled procedure is adopted to test them.

## Procedure

$>$ Two identical groups are selected. These should be 'identical' in terms of the characteristics of the phenomenon under study.
$>$ For example, in a farm productivity experiment, two plots of farmland with same soil composition, soil fertility, same size, same climate and same irrigation facility should be selected for the study.
$>$ One of the groups is used as experimental group, and the other as control group.
$>$ Experimental group is exposed to an experimental variable or stimatulus. Control group is not exposed to the experimental variable.
> The difference between the experimental and control groups' outcome is attributed to the effect of the experiential variable.

## Illustration

$>$ An agricultural scientist desires to study the impact of application of a particular chemical fertilizer (say urea) on the yield of a crop.
$>$ He selects two identical plots of land in a farm. All conditions - soil fertility, climate, irrigation, seed, and cultural practice - are the same.
> Thus, all variables are kept constant.
> In the experimental plot alone, he applied chemical fertilizer. This is the only variation between the two plots.
$>$ Hence, the difference in yield is attributable to the application of the chemical fertilizer.
$>$ In some cases, a single group may be used as both control and experimental group.
> For example, a cooperative extension worker wants to know the effect of a member education programme on the cooperative knowledge of the members of a cooperative.
$>$ He selects a cross section of members of exposes them to a member education programme. He again measures their knowledge.
> The difference in knowledge can be attributed to the programme.

## Conditions

From the analysis of the above procedure, the conditions required for an experimental study may be identified. They are:
> It should be possible for selecting exactly identical groups. This possibility exists in physical and natural sciences, but not so in social sciences, which deal with human life. It is difficult to find exactly identical groups of persons. We may get approximately similar groups only.
> The target groups should be amenable for experimentation. This is ensured in physical sciences. But human beings may not always be willing to be subject to experimentation.
$>$ It should be possible to identify all the independent variables that affect the dependent variables under study. This again is ensured in physical sciences, but not in social phenomena, as our knowledge of human mind and behavior is limited.
> It should be possible to keep non-experimental variables constant so as to study the effect of experimental variables on the phenomenon. Such close controls over the subject variables
are possible in laboratory experimentation. But they are almost impossible in human life situations, which are dynamic and complex. Thus, strictly controlled experimentation is rarely feasible with human beings.
> Nevertheless, useful and fairly valid experimental research is possible in several areas of social sciences such as economic development, welfare programmers, social education, teaching technology, political administration, industrial and agricultural finance, management of enterprises and institutions and so on.

## Evaluation of Experimental Research

$>$ The use of experimental designs in social science research is complicated. It is difficult to establish comparable experimental and control groups.
> There are limits to experimentation among human beings. Experiment is often difficult to design, it is expensive and time consuming.
$>$ It can be used to study the present only, and cannot be used for studies of the past or the future.
$>$ Nevertheless, experimentation has certain unique advantages.
> No other method can equal experimentation in objectivity and in studying causal relationships between variables.
> The effect of extraneous variables can be controlled more effectively in experimental design in other designs.
$>$ Above all, an experimental design offers a means for testing social values.

## Descriptive Research (Method)

## Meaning

$>$ Descriptive study is a fact-finding investigation with adequate interpretation. It is the simplest type of research.
> It is more specific than an exploratory study, as it has focus on particular aspects or dimensions of the problem studied.
$>$ It is designed to gather descriptive information and provides information for formulating more sophisticated studies.
> Data are collected by using one or more appropriate methods: observation, interviewing and questionnaire.

## Criteria

$>$ All problems do not lend themselves to descriptive study. This method is applicable to problems, which satisfy certain criteria.
> First, the problem must be describable and not arguable. For instance, philosophical and controversial issues are not suitable for descriptive study.
$>$ Second, the data should be amenable to an accurate, objective, and if, possible, quantitative assemblage for reliability and significance.
> Third, it should be possible to develop valid standards of comparison. Last, it should lend itself to verifiable procedure of collection and analysis of data.

## Objective

$>$ A descriptive study aims at identifying the various characteristics of a community or institution or problem under study, but it does not deal with the testing of proposition or hypothesis.
> However, it "can reveal potential relationships between variables thus setting the stage for more elaborate investigation later.
$>$ A descriptive study also aims at a classification of the range of elements comprising the subject matter of study. The classification must satisfy two criteria, viz.

1. Exhaustiveness and
2. Mutual exclusiveness

- Exhaustiveness is achieved when all the important elements are identified.
- Mutual exclusiveness occurs when each item can be unambiguously placed in only one category in the system.
- Descriptive information should also be useful for explanation, prediction and awareness.


## Descriptive Study vs. Analytical study

$>$ A descriptive study identifies relevant variables but does not aim at testing hypothesis.
> On the other hand, an analytical study is primarily concerned with testing hypothesis and specifying and interpreting relationships.
$>$ A descriptive study is relatively less limited by the rigorous requirements of measurement and analysis than an analytical study.
> An analytical study's design approximates to the model of an experimental design.
$>$ A descriptive study employs simple statistical techniques like averages and percentages, but an analytical study employs advanced statistical techniques like correlation and multivariate analysis.

## Usefulness

The descriptive studies are useful in their own way.

1. They have much to contribute to the development of a young science, as descriptive information can focus directly on a theoretical point. It may be useful in verifying focal concepts through empirical observation. "The more adequate the description, the greater is the likelihood that the units from the description will be useful in subsequent theory building.
2. Descriptive information can highlight important methodological aspects of data collection and interpretation. The collection of factual data increases our awareness of the relative accuracy of our measuring devices. Thus, our ability to accumulate further knowledge is significantly broadened.
3. Descriptive information obtained in a research may be useful for prediction about areas of social life outside the boundaries of the research.

Descriptive studies are valuable in providing facts needed for planning social action programmes.

## Limitations

The descriptive method of study has certain limitations:

1. It is not applicable to problems, which cannot satisfy the required criteria mentioned earlier.
2. The researcher may make description an end in itself. Research must lead to discovery of facts.
3. Although social science problems are continuous and have a past and future, the research may lose himself in current conditions only.
4. The researcher may tend to over-use statistics. In making statistical analysis, its limitations should be recognized.

## Historical Research

## Meaning

> Historical study is a study of past records and other information sources with a view to reconstructing the origin and development of an instruction or a movement or a system and discovering the trends in the past.
> It is descriptive in nature. It is a difficult task; it must often depend upon inference and logical analysis of recorded data and indirect evidences rather than upon direct observation.
$>$ Hence, it is aptly described as 'the induction of principles through research into the past and social forces which have shaped the present.

## Objective

$>$ Its objective is to draw explanations and generalizations from the past trends in order to understand the present and to anticipate the future.
$>$ It enables us to grasp our relationship with the past and to plan to more intelligently for the future.
$>$ The past contains the key to the present and the present influences the future.
$>$ Historical study helps us in visualizing the society as a dynamic organism and its structures and functions as evolving, steadily growing and undergoing change and transformation.

## Sources of Data

The sources of data for historical research consist of

1. Eyewitness accounts narrated by an actual observer or participant in an event;
2. Oral testimony by elders;
3. Records and other documentary materials; and
4. Relics.

- The data available from the above sources may be scattered and discontinuous and fragmented.
- Personal accounts are mostly subjective and so should be studied with great caution and corroborated with documentary evidences.
- The origin and genuine of the sources and the validity of facts contained in them should be critically tested and examined.
- Their authenticity should be tested. Only authentic sources should be depended upon for collection of data.
- It is essential to check and cross-check the data from as many sources as possible.


## Steps in Historical Research

$>$ First, the feasibility of the study should be examined. The researcher should see whether the selected problem lends itself to historical analysis.
$>$ It should be one of tracing and describing the past or relating to the recent past to draw out its significance for the present and the future.
$>$ It should also be feasible in terms of his research ability, time and cost.
$>$ Second, the selected problem should be formulated and the plan of study should be designed.
$>$ Third, the sources of data should be located.
$>$ Fourth, the genuiness of the sources and the validity of the facts contained in them should be tested.
$>$ Fifth, relevant facts should be collected from the authentic sources and they should be checked and cross-checked.
> Sixth, the facts should be arranged into a logical sequence and this synthesis of facts is the basis for rebuilding of the past situation.
> Last, by adopting induction process meaningful interpretations and generalizations should be made.
> The quality of a historical study depends on the relevance, adequacy and completeness of facts collected, their reliability, and the ingenuity of the researcher in classifying and integrating them and in drawing inferences.

## Limitations and Difficulties

> As the historical study is concerned with the past, reliable and adequate data may not be available. The remoter is the past, the greater is the difficulty in obtaining relevant facts.
> It is also difficult to test the genuineness and authenticity of sources, and the data available from them; Personal biases and private interpretations often enter unconsciously.
> It is difficult to establish the time order of events.
$>$ The records available are not kept in the order and with the precision that a researcher expects. Hence, his inferences may not be full or accurate.
$>$ The dispersal of documents is another limitation. The researcher may not succeed in locating all documents.
> It is difficult to perceive the real significance of the data because of their remote time period. Further, in historical research, precise measurements, verifications and replication are not possible.
$>$ Nevertheless, a thorough and systematic historical study is of immense use in understanding the past and drawing inferences for the present and future.

## Methods of Data Collection:-

## COLLECTION OF PRIMARY DATA

We collect primary data during the course of doing experiments in an experimental research but in case we do research of the descriptive type and perform surveys, whether sample surveys or census surveys, then we can obtain primary data either through observation or through direct communication with respondents in one form or another or through personal interviews. This, in
other words, means that there are several methods of collecting primary data, particularly in surveys and descriptive researches. Important ones are:
i. Observation methods
ii. Interview methods
iii. Questionnaire Methods
iv. Case Study Methods
I. Interview method:-

Interview is the verbal conversation between two people with the objective of collecting relevant information for the purpose of research.

## Definition:

According to McNamara, 1999
$>$ Interviews are particularly useful for getting the story behind a participant's experiences.
> The interviewer can pursue in depth information around the topic.
$>$ Interviewers may be useful as follow up to certain respondents.
Types of Interview:
> Personal interview
> Telephone interview
> Focus group interview
$>$ Depth interview
> Projective interview

## Personal interview:

Personal interview is a face to face two way communication between the interviewer and the respondents. Generally the personal interview is carried out in a planned manner and is referred to as structured interview. This can be done in many for e.g. door to door or as a planned formal executive meeting.

## Methods of conducting an personal interview:

A personal interview involves a lot of preparation. Generally an personal interview should go through the following five stages they are as follows:

```
Rapport building
Introduction
```

Probing
Recording
> Closing

## Rapport Building:

1. Interviewer should increase the receptiveness of the respondent,
2. By making him believe that his opinions are very useful to the research and is going to be a pleasure rather than an ordeal

## Introduction:

1. An introduction involves the interviewer identifying himself by giving him his name, purpose and sponsorship if any.
2. An introductory letter goes a long way in conveying the study's legitimacy.

## Probing:

Probing is the techniques of encouraging the respondents to answer
Completely
Freely
Relevantly

## Recording:

The interviewer can either write the response at the time of interview or after the interview.
In certain cases, where the respondent allows for it audio or visual aids can be used to record answers.

## Closing:

After the interview, interviewer should thank the respondent and once again assure him about the worth of his answers. And also the confidentiality of the same.

## Telephone interview:

Telephone interview the information is collected from the respondent by asking him question on the phone is called as telephone interview. The combination of telephone and computer has made this method even more popular.

## Focus group interview:

Focus group interview is an instructed interview which involves a moderator leading a discussion between a small group of respondents on a specific topic.

## Depth Interview:

Depth interview is nondirective in nature where the respondent is given freedom to answer wthin the boundaries of the topic of interview.

## Projective techniques:

$>$ Projective techniques involve the presentation of an ambiguous, unstructured object, activity or person that a respondent is asked to interpret and explain.
$>$ In projective techniques, the respondents are asked to interpret the behaviour of others and this way they indirectly reveal their own behaviour in the same situation.

## Conclusion:

So we can use the interview techniques as one of the data collection methods for the research.

It makes the researcher to feel that the data what he collected is true and honest and original by nature because of the face to face interaction.

## II. Observation Methods:-

Observation means viewing or seeing. We go on observing something or other while we are awake. Most of such observations are just causal and have no specific purpose. But observation in a method of data collection is different from such causal viewing.

Observation may be defined as a systematic viewing of a specific phenomenon in its proper setting for specific purpose of gathering data for a particular study. Observation as a method includes both 'seeing' and 'hearing'. It is accompanied by perceiving as well.

Observation also plays a major role in formulating and testing hypothesis is social sciences. Behavioural scientists observe interactions in small groups; anthropologists observe simple societies, and small communities; political scientists observe the behavior of political leaders and political institutions. In a sense, as the Webbs have pointed out, all social research begins and ends with observation. A researcher silently watching a city council or a trade union committee or quality circle or a departmental meeting or a conference of politicians or others picks up hints that help him to formulate new hypothesis. He can test them through further observation and study.

## Characteristics

Observations as a method of data collection have certain characteristics.

1. It is both a physical and a mental activity. The observing eye 'catches' many things which are slighted, but attention is focused on data that are pertinent to the given study.
2. Observation is purpose. It is made for the specific purpose of noting things relevant to the study.
3. It grasps the significant events and occurrences that affect social relations of the participants.
4. Observation should be exact and be based on standardized tools of research such as observation schedule, social-metric scale, etc., and precision instruments, if any.

## Types of Observation

Observation may be classified in different ways. With reference to investigator's role, it may be classified into (a) Participant observation, and (b) Non-participant observation. In terms of mode of observation, it may be classified into (c) direct observation and (d) indirect observation. With reference to the rigor of the system adopted, observation is classified into (e) controlled observation, and (f) uncontrolled observation.

## Participant Observation

In this observation, the observer is a part of the phenomenon or group which is observed and he acts as both an observer and a participant. For example, a study of tribal customs by an anthropologist by taking part in tribal activities like folk dance. The persons who are observed should not be aware of the researcher's purpose. Then only their behaviour will be 'natural'.

## The advantages of participant observation are:

1. The observer can understand the emotional reactions of the observed group, and get a deeper insight of their experiences.
2. The observer will be able to record context which gives meaning to the observed behaviour and heart statements.

## Participant observation suffers from some demerits.

1. To the extent that the participant observer participates emotionally, the objectivity is lost.
2. Another limitation of this method is the dual demand made on the observer. Recording can interfere with participation, and participation can interfere with observation. Recording on the spot is not possible and it has to be postponed until the observer is alone. Such time lag results in some inaccuracy in recording.

## Non-participant Observation

In this method, the observer stands apart and does not participate in the phenomenon observed. Naturally, there is no emotional involvement on the part of the observer. This method calls for skill in recording observations in an unnoticed manner.

## Direct Observation

This means observation of an event personally by the observer when it takes place. This method is flexible and allows the observer to see and record subtle aspects of events and behaviour as they occur. He is also free to shift places, change the focus of the observation. A limitation of
this method is that the observer's perception circuit may not be able to cover all relevant events when the latter move quickly, resulting in the incompleteness of the observation.

## Indirect Observation

This does not involve the physical presence of the observer, and the recording is done by mechanical, photographic or electronic devices, e.g. recording customer and employee movements by a special motion picture camera mounted in a department of a large store. This method is less flexible than direct observation, but it is less biasing and less erratic in recording accuracy. It also provides a permanent record for an analysis of different aspects of the event.

## Controlled Observation

This involves standardization of observational techniques and exercise of maximum control over extrinsic and intrinsic variables by adopting experimental design and systematically recording observation.

Controlled observation is carried out either in the laboratory or in the field. It is typified by clear and explicit decisions on what, how and when to observe. It is primarily used for inferring causality, and testing and causal hypothesis.

## Uncontrolled Observation

This does not involve control over extrinsic and intrinsic variables. It is primarily used for descriptive research. Participant observation is a typical uncontrolled one.

## Planning Observation

The use of observation method requires proper planning.

1. First, the researcher should carefully examine the relevance of observation method to the data needs of the selected study.
2. Second, he must identify the specific investigative questions which call for use of observation method. These determine the data to be collected.
3. Third, he must decide the observation content, viz., specific conditions, events and activities that have to be observed for the required data. The observation content should include the relevant variables.
4. Further, for each variable chosen, the operational definition should be specified.
5. Fifth, the observation setting, the subjects to be observed, the timing and mode of observation, recording, procedure, recording instruments to be used, and other details of the task should be determined.
6. Last, observes should be selected and trained. The persons to be selected must have sufficient concentration powers, strong memory power and unobtrusive nature. Selected persons should be imparted both theoretical and practical training.

## Conditions of Effective Observation

These conditions consist of :

1. Observations must be done under conditions which will permit accurate results. The observer must be in vantage point to see clearly the objects to be observed. The distance and the light must be satisfactory. The mechanical devices used must be in good working conditions and operated by skilled persons.
2. Observation must cover sufficient number of representative samples of the cases.
3. Recording should be accurate and complete.
4. The accuracy and completeness of recorded results must be checked. A certain number of cases can be observed again by another observer / another set of mechanical devices, as the case may be. If it is feasible, two separate observers and sets of instruments may be used in all or some fo the original observations. The results could then be compared to determine their accuracy and completeness.

## Observation Tools and Recording Devices

Systematic observation requires the use of observation schedule, diary and various mechanical recording devices.

Schedule: It should be constructed in such a manner as to make it possible to record the necessary information easily and correctly. Enough space should be provided for recording observations for each item. The item should appear in logical groupings and in the order in which the observer would observe them.

Field observation log: this may take the form of diary or card. Each item of observation is recorded under appropriate sub-heading. At the time of observation, rough noting may be made, and at the end of the day, full $\log$ may be made. The card system is flexible and facilitates arrangement and re-arrangement of items in any desired order.
Mechanical devices: these may include cameras, tape recorders, videotape and electronic devices. Still, motion, sound, colour and time-lapse cameras give a permanent record of events, microscopic and telescopic lens may be used in cameras.

## Advantages

Observation has certain advantages

1. The main virtue of observation in its directness, it makes it possible to study behavior as it occurs. The researcher need not ask people about their behavior and interactions; he can simply watch what they do and say.
2. There is no such artificiality in observational studies, especially when the observed persons are not aware of their being observed.
3. Observation is more suitable for studying subjects who are unable to articulate meaningfully, e.g. studies of children, tribal, animals, birds, etc.
4. The validity of what men of position and authority say can be verified by observing what they actually do.
5. Observation makes it possible to capture the whole event as it occurs. For example, only observation can provide an insight into all the aspects of the process of negotiation between union and management representatives.
6. Observation is less demanding of the subjects and has less biasing effect on their conduct than does questioning.
7. Mechanical devices may be used for recording data in order to secure more accurate data and also of making continuous over longer periods.

## Limitations

Observation cannot be used indiscriminately for all purposes. It has its own limitations.

1. Observation is of no use of studying past events or activities. One has to depend upon documents or narrations by people for studying such things.
2. It is not suitable for studying opinions and attitudes. However, an observation of related behavior affords a good clue to the attitudes, e.g. and observation of the seating patterns of high caste and class persons in a general meeting in a village may be useful for forming an index or attitude.
3. Observation poses difficulties in obtaining a representative sample. For interviewing and mailing methods, the selection of a random sampling can be readily ensured. But observing people of all types does not make the sample a random one.
4. Observation cannot be used as and then the researcher finds it convenient to use it. He has to wait for the event to occur. For example, an observation of folk dance of a tribal community is possible, only when it is performed.
5. A major limitation of this method is that the observer normally must be at the scene of the event when it takes place. Yet it may not be possible to predict where and when the event will occur, e.g. road accident, communal clash.
6. Observation is a slow and expensive process, requiring human observers and / or costly surveillance equipment's.

## III.CASE STUDY METHOD:

Case studies investigate contemporary cases for purposes of illumination and understanding. In some instances case studies are used to provide information for decision making or to discover
casual links in setting where cause and effect relationship are complicated and not readily know, such as school reform or a particular government policy.

Case study researchers examine each case expecting to uncover new and unusual interaction, events, explanations, interpretations, and cause and effect connections.

## What is case studies?

$>$ A case study is an in depth study of a particular situation. It is a method used to narrow down a very broad field of research into one easily researchable topic.
$>$ The case study research design is also useful for testing whether scientific theories and model actually work in the real world.
$>$ A case study is an ideal methodology when a holistic, in -depth investigation is needed.
$>$ It is a systemic inquiry into an event or a set of related events which aims to describe and explain the phenomenon of interest.

## Why case study research?

> The case study method is amongst the most flexible of research designs, and is particularly useful in researching issues related to sustainability and institutional systems.
$>$ Case study research can serve a variety of functions: exploratory (enabling researchers to get a feeling for potentially important variables and to describe phenomena in the appropriate contextual setting).
$>$ Testing hypotheses or theories (relating to cause and effect).

## Types of Case Studies:

> Historical Case study
> Observational Case study
> Oral History case study
> Situational Case study
> Clinical Case Study
> Multi Stage Case Study

## Focuses of Study

Case studies are classified according to the focus of study. This can include:
> Individuals
$>$ Communities
> Social groups
$>$ Organizations and Institutions, and
$>$ Events, roles, relationships, and interactions.

## Functions of case Studies:

> The case study method describes a case in terms of its peculiarities.
> It gives us an insight into the typical or extreme cases whose unique features are not reflected by the usual statistical method.
$>$ A case study helps to secure a wealth of information about the unit of study, which may provide clues and ideas for further research.
> It provides an opportunity for the intensive analysis of many specific details that are overlooked in other methods.
> It examines complex factors involved in a given situation so as to identify causal factors operating in it.

## Designing Study....

## Five Steps of research design:

$>$ conducting literature review,
$>$ Constructing a theoretical framework,
> Identifying a research problem,
> Crafting and sharpening research questions,
> And selecting the sample (purposive sampling).
Tools for data gathering Case study....
Documentation, archival records, Interviews, open ended questionnaire, And participant observation.

## Merits:

The merits of a case study method far exceed its limitations.
> Case studies are flexible with respect to data collection methods. All methods of data collection are useful to case studies.
$>$ A case study can extend virtually to any dimension of the topic studied. All aspects may be studied or specific aspects may be emphasized.
$>$ Case studies may be conducted in practically any kind of social setting.
$>$ Case studies offer specific instances of tests of theories.
$>$ Case study is a highly fruitful approach for the purpose of group or process analysis as against the analysis of individual traits alone.

## Conclusion:

Research could be extensive or detail. Case study enables to conduct details study. Particularly case is very useful in having complete understanding of the given case. Library researchers should conduct more and more case studies so as to have complete understanding of their libraries, users' programmes, and activities.

## STEPS IN RESEARCH

## INTRODUCTION

Research process is similar to undertaking a journey with specific mission. Before starting the journey we decide where you want to go and which route to follow. If the route is known to you don't need anybody guidance but if there are more than one route towards destination than you have to decide which route is most suitable to reach the destination. Now you look upon the research process in this context. Your first decision would be 'what you want to find out about 'or in other words what research question to be answered to. After deciding the research question or problem you should now decide 'how to go about finding there answers'. Therefore precisely the path to finding answers to research questions constitutes research methodology. In research process you passed through some practical steps in order to find out the answers of research questions. This unit will familiarize you with important steps needed for conducting a research. You will provide a quick glance at the whole process of research to acquaint you with the various tasks you faced to undertake to carry out your research / study.

## OBJECTIVES:

After reading this unit, you will be able to:
$>$ Identify the various steps needed for conducting a research;
$>$ Explain the whole process of research in simple manner;
$>$ Discuss how theoretical knowledge can be further applied to undertake a research; and
> Analyse the importance of each steps involved in research process

## RESEARCH PROCESS

The goal of the research is to find the truth and to use a scientific method that results in a reasonable and sound answers to important questions that will further our understanding of human behaviour. Research process consists of series of actions and steps needed for conducting scientific research. If the researcher follows certain steps in conducting the research, the work can be
carried smoothly with least difficulty. The proposed flow chart given below illustrates the research process:

The research process consists of a number of closely related activities as shown through step I to step X, but such activities overlap continuously rather than following strictly prescribed sequence. The order of various steps shown provides a useful procedural guidelines regarding research process. Details of each of the research stages is given underneath.
$>$ Identification of the Problem
$>$ View of Literature
> Formulating a Hypothesis
$>$ Identifying, Manipulating and Controlling Variables
$>$ Formulating a Research Design
$>$ Constructing Devices for Observation and Measurement
$>$ Sample Selection and Data Collection
$>$ Data Analysis and Interpretation

## HYPOTHESES:-

$>$ Hypothesis is a tentative proposition formulated for empirical testing. It is a tentative answer to a research question.
$>$ It is tentative, because its veracity can be evaluated only after it has been tested empirically.
$>$ Lundberg defines hypothesis as 'a tentative generalization, the validity of which remains to be tested.'
$>$ Goode and Hatt define it as 'a proposition which can be put to a test to determine its validity.'

## Types of Hypotheses

Hypotheses are classified in several ways. With reference to their function, hypotheses are of two types:
a) Descriptive Hypotheses and
b) Relational Hypotheses.
a) Descriptive Hypotheses: These are propositions that describe the characteristics (such as size, form or distribution) of a variable. The variable may be an object, person, organization, situation or event. Some examples are:
"The rate of unemployment among arts graduates is higher than that of commerce graduates."
"Public enterprises are more amenable for centralized planning."
"The Educational system is not oriented to human resource needs of a country."
b) Relational Hypotheses: These are propositions, which describe the relationship between two variables. The relationship suggested may be positive or negative correlation or causal relationship. Some examples are:
"Families with higher incomes spend more for recreation."
"Upper-class people have fewer children than lower-class people."
"Labour productivity decreases as working duration increases."
Another approach is to classify them into
c) Working Hypotheses
d) Null Hypotheses
e) Statistical Hypotheses
f) Common-sense Hypotheses.
c) Working Hypotheses: While planning the study of a problem, hypotheses are formed. Initially they may not be very specific.
> In such cases, they are referred to as "Working Hypotheses" which are subject to modification as the investigation proceeds.
d) Null Hypotheses: These are hypothetical statements denying what are explicitly indicated in working hypotheses.
They state that no difference exists between the parameter and the statistic being compared to it.
>For example, even though there is relationship between a family's income and expenditure on recreation, a null hypothesis may state: "There is no relationship between families income level and expenditure on recreation."
$>$ Null hypotheses are formulated for testing statistical significance, since, this form is a convenient approach to statistical analysis.
$>$ As the test would nullify the null hypotheses, they are so called.
> Moreover, null hypotheses are more exact. It is easier to reject the contrary of a hypothesis than to confirm it with complete certainty.
$>$ Hence, the concept of null hypotheses is found to be very useful.
e) Statistical Hypotheses: These are statements about a statistical population. These are derived from a sample. These are quantitative in nature in that they are numerically measurable, e.g. "Group A is older than Group B."
f) Common-sense Hypotheses: These represent the common sense ideas. They state the existence of empirical infirmities perceived through day to day observations.
> Many empirical uniformities may be observed in business establishments, the social background of workers, and the behaviour patterns of specific groups like students, e.g. "shop-assistants in small shops lack motivation."
> "Solders from upper-class are less adjusted in the army than lower class men."
> "Fresh students conform to the conventions set up by seniors."

## Sources of Hypotheses

1. Theory: This is one of the main sources of hypotheses. It gives direction to research by stating what is known.
2. Observation: Hypotheses can be derived from observation. From the observation of price behavior in a market, for example, the relationship between the price and demand for an article is hypothesized.
3. Intuition and personal experience: may also contribute to the formulation of hypotheses.
a. Personal life and experiences of persons determine their perception and conception.
b. The story of Newton and the falling apple, the flash of wisdom to Buddha under the Banyan tree illustrate this individual accidental process.
4. Findings of the Study: Hypotheses may be developed out of the findings of other studies in order to replicate and test.

## The Functions of Hypotheses

In social science research, a hypothesis serves several important functions.

1. A hypothesis gives a definite point to the investigation, and it guides the direction on the study.
a. Without a hypothesis, research becomes unfocussed.
b. The researcher would get stranded in a cross road, not knowing the direction in which to proceed.
c. A hypothesis, thus, directs our search for the order among facts.
2. A hypothesis specifies the sources of data, which shall be studied, and in what context they shall be studied.
3. It determines the data needs. It defines which facts are relevant and which are not.
4. A hypothesis suggests which type of research is likely to be most appropriate.
5. It determines the most appropriate technique of analysis.

## VARIABLES:-

## Meaning of variable?

$>$ Variable is central idea in research. Simple defined as, variable is a concept that varies. It can be in quantity, intensity, amount and types.
$>$ It takes two or more values.
> Variable is a measurable characteristics that varies. It may change from group to group, person to person or within person over time.
$>$ In research science, variable refer to factor or condition that can change during the course of an experiment.
> Thus, variable is anything that may assume different numerical and categorical values.

## Example of variable:

1. Gender is a variable it can take two values:- male and Female
2. Marital status is a variable. It can take on values of never married, single, married divorced or widowed.
3. A variable may be situation specific.

## Different Types of Variables in a Research

Variables are attributes to which various values can be assigned.
A variable involves anything that can accept different values. The mentioned values might be different for different individuals and objects that the scores of an individual on various tests can be considered as an example with regard to the issue.

In a general definition, it can be stated that it is an attribute or a factor which is shared among a society's population having the capacity of taking different values that the assigned value to a variable is demonstrative of a change from an individual to another or from a state to the next.

## Types of variables

According to the role(s) that variables play in a research, they are divided into two categories:

## > Independent Variables

An Independent variable is a variable based on which the dependent variable is predicted. This variable is chosen, manipulated and measured by the researcher aimed at figuring out its relationship with other variables.

The independent variable might have a positive or negative effect on the dependent variable; that is, any kind of change in the independent variable might result in a change in the dependent
variable. Accordingly, the reason behind the dependent variable's change can be looked for in the change which has been applied to the independent variable. In a non-experimental research, the independent variable is not manipulated, and intact groups are chosen assuming that the independent variable has an effect on the dependent variable. For more elaboration, two examples are hereby presented:
Example 1: "Various social classes have an effect on knowledge improvement". In this example, the various social classes and knowledge improvement are considered as the independent and dependent variables, respectively.
Example 2: "Organizational structure has an effect on customers' satisfaction". In this example, the organizational structure and customers' satisfaction are the independent and dependent variables, respectively.

## > Dependent Variables

Defendant variable is a variable in which the researcher is interested and in contrary to the independent variable, the dependent variable is not in the control of the researcher, and he/she is not able to manipulate it. In its definition, it could be stated that it is a variable which is affected by the independent variable, it is changed based on the independent variable's changes and the researcher's goal is predicting and describing its changeability. For more clarifications, the following examples are hereby presented:
Example 1: Investigating the effect of women's employment on family life satisfaction Women's employment is an independent and family life satisfaction is a dependent variable.
Example 2: The effect of the sun on plants' growth__ the sun and plants' growth are the independent and dependent variables, respectively.

Example 3: Investigating the effect of educational courses on the workers' occupational performance $\qquad$ Educational courses and occupational performance are the independent and dependent variables, respectively.

In addition to the main variables_independent and dependent ones, there are some other variables affecting the outcome of the research which are briefly described as follow:

## > Moderator Variable

The moderator variable changes the relationship between the independent and dependent variable. In points of the fact, the presence of the third variable affects the relationship which was expected from the main variables; thus, it can be considered as the second independent variable.
Example: In an investigation of the effect of students' IQ on their average, in case of significant difference among the male and female students' IQ and average, gender can be accounted as the moderator variable.

## Control Variables

It happens in some occasions that the researcher decides to delete or neutralize the effect of some variables since examining all the variables simultaneously seems impossible and uncontrollable for him/her that the mentioned variables are called control variables. It is noteworthy that in some particular cases, the moderator variable can play the control variable' role.

Example: Investigating the effect of the simulated tests on the students' success in the final tests $\qquad$ simulated tests and success in the final tests are independent and dependent variables, respectively. In this design, the students' major can be considered as the control variable.

## Thesis and Article writing: Format and styles of referencing.

## What is Thesis?

$>$ "A written work resulting from Original research, especially one submitted for higher degree in a University".

## Why write a thesis?

$>$ Science aims to find Pattern, trends and structure in the experiment
$>$ Good Scientific writing aims to bring forward in the text (Structure, Organization of scientific knowledge)
$>$ Organization of scientific knowledge

## Structure of a thesis or Report?

$>$ Preliminary Pages
> Introduction
> Review of Related Literature
> Methods and procedure
$>$ Analysis of data and result
$>$ Summary and Conclusions
> References

## Preliminary Pages:

$>$ Title page :- The title (and possibly the subtitle) of your thesis

- First name and surname of the author(s)
- Whether it is a Bachelor's thesis or Master's thesis
- Faculty and department
- Place and date of completion
> Acknowledgement: - This is a page focused on expressing gratitude to organizations, agencies or individuals who, in one way or another, have aided the researchers in finishing the thesis.


## Table of Contents:-

$\checkmark$ The table of contents is essentially a topic outline of the thesis.
$\checkmark$ It is compiled by listing the headings in the thesis down to whichever level you choose.

## > List of Tables or Figures:-

$\checkmark$ Include a list of figures and a list of tables if you have one or more items in these categories.
$\checkmark$ Use a separate page for each list.
$\checkmark$ List the number, caption, and page number of every figure and table in the body of the thesis.

Figures, tables, illustrations what is the difference?
$\checkmark$ If you are doing a design or fine arts subject, it is likely that you will include photographs, drawings, paintings or illustrations in your dissertation. These would normally be included in your list of illustrations.
$\checkmark$ In other subjects, it common to include all tables, charts, graphs, photographs, drawings, etc. Together in a list of figures.

However, if you have a great deal of information presented in tables, it may be best to have a both a list of tables and a list of figure these separately.

## > Abstract:-

- An abstract presents a brief summary of your thesis.
- The aim of the abstract is to briefly provide the reader with the most important information from the entire text.
- An abstract never contains new information. This summary is no longer than 2 pages of A4.
- In 350 words for Ph.D
- 150 words for a Masters
- The abstract must summarize the contents of the thesis, not merely say what it is about. Write it last because you must have written the introduction and conclusion before you can summarize their main ideas in the abstract.


## > List of Abbreviations:-

## Chapter-1: Introduction:

A description of the general problem followed by a statement of the specific problem and the motivation for the study
> The first chapter of your thesis is your introduction
$>$ This is where you provide an introduction to the topic of your thesis: you give the contest in terms of content of the research project.

## Writing good introduction:-

$>$ The first paragraph :- Should provide a brief background in present tense to establish context relevance or nature of the problem, question or purpose
> Next second paragraph:- may include the importance of the problem and unclear issues.
> The last paragraph :- should state the rationale, hypothesis, main objective or purpose

## Significance of the study:-

> The significance of the study will mainly focus on the question "Who will benefit from the study?.
> This section will state the contribution of your study and the usefulness of your study in the society.

## Statement of the Problem:-

> The problem must be reflected to your title or the readers must know your problem by just simply reading your topic.
$>$ The problem must not be answerable by yes or no and must be arranged in the flow of your documentation or study.

## Definitions of the concepts:-

$>$ The definition of terms must be arranged in alphabetically. It must be also stated if you used your definition of terms in technically or operationally.

## Scope and Limitations:-

The scope is mainly the coverage of your study and the Delimitation is the limitation of your study or topic.

## Chapterizations:-

> Chapter I- Introduction
> Chapter II- Review of Literature
$>$ Chapter II - Profile of the Study
$>$ Chapter IV- Analysis and Interpretation of Data
$>$ Chapter V - Findings of the study, Suggestions and Conclusion
> References

## Chapter -2: Review of Literature

## What is literature review?

"A systematic method for identifying evaluating and interpreting the work produced by researchers, scholars, practitioners".

Literature review is....." an interpretation and synthesis of published work".
The purpose of this chapter is to show that you are aware of where your own piece of research fits into the overall context of research in your field.

In this part you must get your data and information from any books, Magazines and newspapers. You must label your published material with local or foreign

1. Must be also organized to cover specific problems.
2. Must take all the evidences about the problem with the author's experiences.
3. As much as possible, get the latest published materials.
4. It must be related to your topic. If not do not get it.
5. On the last part of this part you must have a statement how this old published material helps the researcher in their current study and relate it to your study.

## Skills for digesting the literature:-

$>$ Analysis: - Dissecting data into their constituent part.
> Synthesis:- Rearranging the elements derived from analysis to identify relationship.
$>$ Comprehension:- Interpreting and distinguishing between different types of data, theory and argument to describe the substance of an idea.
$>$ Knowledge:- Describing the principles, uses and function of rules, method etc.
Components of literature review:-

## Background information

> Introduce topic
$>$ Describe scope and organization
$>$ Review past and present literature
> Clarify purpose

## Theory:

$>$ All research has a precedent
> Integrate key points and make appropriate inferences
$>$ Be aware of relationship to your topic

## Synthesis:

$>$ List of the work of others
> Identify issues highlighted
> Highlight differences and similarities
> Identify consensus

## Chapter -3 Methods and Procedure

## Does the methodology or research method are....

$>$ Plan, when, where and how the research was done?
> Include subsections or informative headings as appropriate
> Mention which method or tools were used to collect data

## Purpose of Methodology:

There two main things....

1. How was the data collected or generated?
2. How was it analyzed? In other words, it shows your reader how you obtained your results. But why do you need to explain how you obtained your results?
> The purpose of the methodology chapter is to give an experienced investigator enough information to replicate the study. Some advisors do not understand this and require students to write what is, in effect, a textbook. A research design is used to structure the research and to show how all of the major parts of the research project, including the sample, measures and methods of assignment, work together to address the central research questions in the study.
$>$ This chapter should begin with a paragraph reiterating the purpose of the study. The different subjects may or may not be in the order required by a particular institution of higher education, but all of the subjects constitute a defensible methodology chapter.

## Chapter -4: Analysis and Results

$>$ Present the findings of the study in the order of the specific problem as stated in the statement of the problem.

Present the data in these forms:
Tabular
Textual
Graphical (optional)
$>$ Data may be analyzed quantitatively or qualitatively depending on the level of measurement and the number of dimensions and variables of the study.
$>$ If you have organized, displayed and analyzed your data, its time to write it up, and the place for this is the results section.
$>$ The key to a great results section is in describing your results- you need to tell your readers exactly what you find out. This is where you document what was observed or discovered. It is not the place for discussion.

## Discussion:

This section has four purposes are there
Interpret and explain your results
Answer your research question
Justify your approach
Critically evaluate your study

## Conclusion:

This chapter tends to be much shorter than the discussion.
It is not a mere summary of your research, but needs to be conclusions as to the main points that have emerged and what they mean for your field.
$>$ State statistical descriptions in declarative sentences.
> Check for indicators whether hypothesis/ are supported or not by findings.
$>$ Link the present findings with the previous literature.
$>$ Use parallel observations with contemporary events to give credence presented in the introduction.

## References:

Whenever you cite information from another source, you must credit the source in your references. Always check with your instructor to determine which reference style to use like ....APA, Chikago etc.

## Application of ICT in research

## Introduction:

Fast development of ICT (information and communication Technology) to be more specific and internet is the most important phenomenon characterizing the Information age. Many online services in the vicinity of commerce, culture, entertainment and education and research are catered by it. It's a field having its prominent impact.

Electronic mail, video conferencing facsimile and telephone conferencing are the various types of communication in ICT. Storing, retrieving, transmitting and manipulating digital information are the major ICT communications. ICT tools are mainly used by researchers for its ability to ease knowledge-gathering process and to enhance resource-development. Application of ICT changes user to user that how different applications boosts effectiveness and efficiency in the work.

## What is an ICT?

ICT basically comprises of the media for collection, stoage, processing, transmission and presentation of information may be voice, data, text or images along with related services. ICTs can be broadly divided into two parts;

1. Information and communication infrastructure: dealing with physical telecommunication systems and network like cellular, broadcast, cable, satellite, postal and
2. ICT allied services like Internet, voice, mail, radio and television and information Technology(IT) referring to the hardware and software of information collection, storage, processing and presentation.

## ICT in research

Data processing involves the prominent use of ICT. Very unusual Bandwidth and power of computation leads to analyze process huge data along with performing xtremely fast, accurate and reliable complex computations.

Other important aspect of ICT in research in online full text database/research libraries/ virtual libraries which could have been possible due to developments in telecommunications networks and technology.

## ICT APPLICATIONS IN RESEARCH

1. literature search : was not an easy job before ICT since needs to perform a manual search on hard copies of literature in libraries and the search results were limited while a lot of search materials, literature and artifacts today can be searched using Internet search engines and database

Shodh Ganga: Indian theses repository where the theses can be search and download.
Google Scholar: platform providing a broad search for scholarly literature across disciplines and sources.
Microsoft Academic Search: help find information about academic papers, authors, conferences, journals and organizations from multiple sources.
2. Content Search: Today the contents or literature on specific keywords or phrases can be searched by the researcher in a soft copy and is more effective and productive. This supports what Sekaran (2003) had stated that online search using technology is inexpensive and can improve the identification of relevant sources of literature. Such content search also enables a researcher to evaluate quickly whether a particular article or thesis is worth for this or her deeper review.
3. Literature Tracking: initially researchers areto sort, classify and store their literature they have reviewed through computer folders not only this but they are require to create their own tracking mechanism which was just impossible doing this manually. Despite of advancement in ICT, researchers can still use old approaches many researchers nowadays are using software like mendeley, which help mange, share and discover the literature contents and contacts that they had reviewed. Utilizing software like menedeley to track a researchers literature leads to saving time and effort as well as making capable to mange lots of literature which was not possible for the researcher in the past.
4. Data collection: with ICT, data can be collected online, web-based or internet survey. Using these software and internet technology which are greener technology in date collection reduces the time and cost to collect responses from the respondents through surveys. Not only an online survey can be administered more effectively, but the data collected in its original format can also be input directly into the statistical software.

Conclusion: ICT has brought everything available at the finger touch. In today's era ICT has occupied every aspect of life and research is one of them. ICT has its prominent importance in research and allied aspects of it. May it be literature survey, data collection, data processing and analysis in every aspect ICT proven itself as a time saver, accuracy maintainer and making things simplified. Ultimately it leads to speed up in researching new things.

## Research Ethics:-

## Introduction

$>$ Research in several disciplines is gaining importance in the 21st century. In India, agencies like University Grant Commission (UGC) assessing the performance of the faculty based on the Academic Performance Index (API). Irrespective of the aptitude, ability and interest
in research, aspiring researchers are pushing themselves to publish research papers and also are aiming to do Ph.D.

## What is Ethics in Research?

$>$ Norms promote the aims of research, such as knowledge, truth, and avoidance of error. For example, prohibitions against fabricating, falsifying, or misrepresenting research data promote the truth and avoid error.

## Why Ethics is Important in Research?

$>$ Since research often involves a great deal of cooperation and coordination among many different people in different disciplines and institutions, ethical standards promote the values that are essential to collaborative work such as trust, accountability, mutual respect, and fairness.
> Many of the ethical norms help to ensure that researchers can be held accountable to the public. Ethical lapses in research can significantly harm human and animal subjects, students, and the public.

## Elements of Misconduct and Fraud in Research

$>$ Publishing the same paper in two different journals without telling the editor.
> Indulging a colleague as an author on a paper even though the colleague did not make a serious contribution to the paper.
$>$ Discussing with your colleague's confidential data from a paper that you are reviewing for a journal.
$>$ Using inappropriate statistical technique in order to enhance the significance of research work;
$>$ Conducting a review of literature that fails to acknowledge the contributions of other people in the field or relevant prior work;
> Stretching the truth on job application or curriculum vita;
$>$ Failing to keep good research records; Failing to maintain research data for a reasonable period.
$>$ Fabrication is making up data or results and recording or reporting them;
$>$ Falsification is manipulating research materials, equipment, or pro-cesses, or changing or omitting data or results such that the research is not accurately represented in the research record;
$>$ Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit;
$>$ Research misconduct does not include honest error or differences of opinion.

## GENERAL PRINCIPLES IN FOLLOWING ETHICS:

> Honesty: Keep honesty in reporting data, results, methods and procedures and publication.
> Objectivity: Strive to avoid bias in experimental design, data analysis, data interpretation, peer review, personal decisions, grant writing etc.
$>$ Openness: Share data, results, ideas, tools, resources. Be open to criticism and new ideas.
> Confidentiality: protect confidential communications.
> Carefulness: Avoid careless errors and negligence. Keep good record of research activities.
> Respect for Colleagues: Treat them fairly.
> Respect for Intellectual Properties: Honour patents, copyright and the forms of Intellectual property. Give proper acknowledgement or credit for all contributions to research. Never plagiarize.
> Respect for the Law: Know and obey relevant laws and institutional and governmental policies.
> Respect for Research Subjects: Show proper respect and care for animal when using them in research. Do not conduct unnecessary or poorly designed animal experiments. When conducting research on human subjects minimize harms and risks and maximize benefits, respect human dignity, privacy and autonomy; take special precautions with vulnerable groups and strive to distribute the benefits and burdens fairly.
>Stewardship: Make good use of humans, financial and technological resources.
> Social Responsibility: Strive to promote social good and prevent social harms through research, public education and advocacy.
> Freedom: Research institutions and governments should not interfere with freedom of thought and inquiry".

## ETHICS AND PUBLICATION

Plagiarism: The term plagiarism denotes intentional or unintentional borrowing of ideas or words of others without giving appropriate credit.

## Plagiarism can be of several types.

> Plagiarism of Ideas: Plagiarism of ideas may occur when an author presents someone else's ideas, thoughts or inventions as his own without giving appropriate credit. This is very difficult to detect as the scripts from the original paper are not directly reproduced.
>Plagiarism of Text: Plagiarism of text also known as word-for-word plagiarism is the complete or partial copying of words without credit to its author. With the advancement of technology and the digitalisation of medical literature, this is increasingly common.
> Mosaic Plagiarism: The third type of plagiarism, mosaic plagiarism, is perhaps more common: authors copy ideas and sentences from an original source and admix it with a few words of their own here and there. This practice is unethical when the original author is not acknowledged, and the reference is not cited appropriately.
$>$ Self-Plagiarism: Self-plagiarism is another form of plagiarism which refers to the reuse of author's own previous work without appropriate quotation and permission to reproduce text from the copyright holder.
$>$ Data Fabrication: Data fabrication and falsification are serious forms of scientific misconduct. Data fabrication involves invention of data or cases while data falsification is the intentional distortion of data or the results.
$>$ Data Falsification: Data falsification is probably more common. Scientific results can be distorted to show a statistically significant result to meet the expected outcome of a study. A study can be selectively published only when it meets the researchers' expectations. Clearly, scientific misconducts of this kind impact detrimentally on the scientific and the wider community.
$>$ Redundant Publication: Redundant publication involves the publication of the same work more than once in the same or different languages without acknowledging the original source.

## AUTHORSHIP

$>$ An important area of scientific misconduct relates to authorship, which is generally conferred upon individuals who make significant intellectual contributions to a published study and who are responsible for the content of a study
$>$ The Council of Scientific Editors describes a range of authorship misconducts that includes honorary or gift authorship and ghost authorship.
Honorary or Gift Authorship: The practice of offering authorship to individuals who have made no or an insignificant contribution to a manuscript is often referred to as honorary or gift authorship.

Ghost Authorship: Ghost authorship involves an undisclosed conflict of interest where a pharmaceutical industry employee or contractor co-authors a study but is not listed as an author in the publication.

## ETHICAL GUIDELINES FOR RESEARCH IN LIS

> Maintain high standards of work directed towards the constant improvement of the quality of the study.
$>$ Strive to preserve open channels of communication among research workers, scholars, participating professionals, and other persons or groups who might benefit from or apply research results.
> In planning, conducting, and reporting studies, does not misrepresent the investigative competencies and abilities of research workers or associates.
> Protect human subjects by taking all possible measures to respect privacy and the confidentiality of personalized research data.
> Unless subjects have been fully informed of psychological or other risks involved in a given project and have consented to serve as research subjects in full realization of the possibility of stress or discomfort, do not utilize techniques that pose threats to subjects' well-being.
$>$ Let the studies nature and purpose determine the degree of condor to be displayed regarding the exact purpose of a study; as a general rule, however, follow the principle of full disclosure of intend to subjects.
> Report procedures and findings as accurately as possible.
> Give credit to persons whose earlier research was especially useful in the conduct of another project.
$>$ Give credit to research associates who provided direct assistance.
$>$ Acknowledge the aid of persons who served as consultants or helped to plan, conduct, or report research activities.
> When applicable, acknowledge sources of financial grants and other forms of direct or indirect aid.
> Always resist the temptation to accept premature explanations; have the patience to wait for more verified data related to an observed but heretofore inadequately explained phenomenon.
> Always place a high value on intellectual honesty".

## UNIT - 3

## COMPREHENSION

## (A passage of the text be given. Questions to be asked from the passage to be answered)

## Instructions:

## Read the following passage carefully and answer questions 1 to 5

## RC Passage 1

The literary distaste for politics, however, seems to be focused not so much on the largely murky practice of politics in itself as a subject of literary representation but rather more on how it is often depicted in literature, i.e., on the very politics of such representation. A political novel often turns out to be not merely a novel about politics but a novel with a politics of its own, for it seeks not merely to show us how things are but has fairly definite ideas about how things should be, and precisely what one should think and do in order to make things move in that desired direction. In short, it seeks to convert and enlist the reader to a particular cause or ideology; it often is (in an only too familiar phrase) not literature but propaganda. This is said to violate the very spirit of literature which is to broaden our understanding of the world and the range of our sympathies rather than to narrow them down through partisan commitment. As John Keats said, 'We hate poetry that has a palpable design upon us'.

Another reason why politics does not seem amenable to the highest kind of literary representation seems to arise from the fact that politics by its very nature is constituted of ideas and ideologies. If political situations do not lend themselves to happy literary treatment, political ideas present perhaps an even greater problem in this regard. Literature, it is argued, is about human experiences rather than about intellectual abstractions; it deals in what is called the 'felt reality' of human flesh and blood, and in sap and savour (rasa) rather than in alid and lifeless ideas. In an extensive discussion of the matter in her book Ideas and the Novel. the American novelist Mary McCarthy observed thatideas are still today felt to be unsightly in the novel though that was not so in 'former days', i.e., in the 18th an 19th centuries. Her formulation of the precise nature of the incompatibility between ideas on the one hand and the novel on the other betrays perhaps a divided conscience in the matter and a sense of dilemma shared by many writers and readers: 'An idea cannot have Loose ends, but a novel, I almost think, needs
them. Nevertheless, there is enough in common for the novelists to feel. .. the attraction of ideas while taking up arms against them - most often with weapons of mockery.'

## 1: According to the passage, a political novel often turns out to be a

1. Literary distaste for politics
2. Literary representation of politics
3. Novel with its own politics
4. Depiction of murky practice of politics

## 2: A political novel reveals

1. Reality of the things
2. Writer's perception
3. Particular ideology of the readers
4. The spirit of literature

3: The constructs of politics by its nature is

1. Prevalent political situation
2. Ideas and Ideologies
3. Political propaganda
4. Understanding of human nature

## 4: Literature deals with

1. Human experiences in politics
2. Intellectual abstractions
3. Dry and empty ideas
4. Felt reality of human life

## 5: The observation of the novelist, Mary McCarthy reveals

1. unseen felt ideas of today in the novel
2. dichotomy of conscience on political ideas and novels
3. compatibility between idea and novel
4. endless ideas and novels

## RC Passage 2:

Caffeine, the stimulant in coffee, has been called "the most widely used psychoactive substance on Earth.'Synder, Daly and Bruns have recently proposed that caffeine affects behavior by countering the activity in the human brain of a naturally occurring chemical called adenosine. Adenosine normally depresses neuron firing in many areas of the brain. It apparently does this
by inhibiting the release of neurotransmitters, chemicals that carry nerve impulses from one neuron to the next. Like many other agents that affect neuron firing, adenosine must first bind to specific receptors on neuronal membranes. There are at least two classes of these receptors, which have been designated A1 and A2.

Snyder et al propose that caffeine, which is structurally similar to adenosine, is able to bind to both types of receptors, which prevents adenosine from attaching there and allows the neurons to fire more readily than they otherwise would.

For many years, caffeine's effects have been attributed to its inhibition of the production of phosphodiesterase, an enzyme that breaks down the chemical called cyclic AMP. A number of neurotransmitters exert their effects by first increasing cyclic AMP concentrations in target neurons. Therefore, prolonged periods at the elevated concentrations, as might be brought about by a phosphodiesterase inhibitor, could lead to a greater amount of neuron firing and, consequently, to behavioral stimulation. But Snyder et al point out that the caffeine concentrations needed to inhibit the production of phosphodiesterase in the brain are much higher than those that produce stimulation. Moreover, other compounds that block phosphodiesterase's activity are not stimulants.

To buttress their case that caffeine acts instead by preventing adenosine binding, Snyder et al compared the stimulatory effects of a series of caffeine derivatives with their ability to dislodge adenosine from its receptors in the brains of mice. "In general," they reported, "the ability of the compounds to compete at the receptors correlates with their ability to stimulate locomotion in the mouse; i.e., the higher their capacity to bind at the receptors, the higher their ability to stimulate locomotion." Theophylline, a close structural relative of caffeine and the major stimulant in tea, was one of the most effective compounds in both regards. There were some apparent exceptions to the general correlation observed between adenosine-receptor binding and stimulation.One of these was a compound called 3-isobuty1-1-methylxanthine(IBMX), which bound very well but actually depressed mouse locomotion. Snyder et al suggest that this is not a major stumbling block to their hypothesis. The problem is that the compound has mixed effects in the brain, a not unusual occurrence with psychoactive drugs. Even caffeine, which is generally known only for its stimulatory effects, displays this property, depressing mouse locomotion at very low concentrations and stimulating it at higher ones.

## Based on the Passage, answer the following questions:

## 1. The primary purpose of the passage is to

(A) discuss a plan for investigation of a phenomenon that is not yet fully understood
(B) present two explanations of a phenomenon and reconcile the differences between them
(C) summarize two theories and suggest a third theory that overcomes the problems encountered in the first two
(D) describe an alternative hypothesis and provide evidence and arguments that support it
(E) challenge the validity of a theory by exposing the inconsistencies and contradictions in it
2. According to Snyder et al, caffeine differs from adenosine in that caffeine
(A) stimulates behavior in the mouse and in humans, whereas adenosine stimulates behavior in humans only
(B) has mixed effects in the brain, whereas adenosine has only a stimulatory effect
(C) increases cyclic AMP concentrations in target neurons, whereas adenosine decreases such concentrations
(D) permits release of neurotransmitters when it is bound to adenosine receptors, whereas adenosine inhibits such release
(E) inhibits both neuron firing and the production of phosphodiesterase when there is a sufficient concentration in the brain, whereas adenosine inhibits only neuron firing
3. In response to experimental results concerning IBMX, Snyder et al contended that it is not uncommon for psychoactive drugs to have
(A) mixed effects in the brain
(B) inhibitory effects on enzymes in the brain
(C) close structural relationships with caffeine
(D) depressive effects on mouse locomotion
(E) the ability to dislodge caffeine from receptors in the brain
4. According to Snyder et al, all of the following compounds can bind to specific receptors in the brain EXCEPT
(A) IBMX
(B) caffeine
(C) adenosine
(D) theophylline
(E) phosphodiesterase
5. Snyder et al suggest that caffeine's ability to bind to $A 1$ and $A 2$ receptors can be at least partially attributed to which of the following?
(A) The chemical relationship between caffeine and phosphodiesterase
(B) The structural relationship between caffeine and adenosine
(C) The structural similarity between caffeine and neurotransmitters
(D) The ability of caffeine to stimulate behavior
(E) The natural occurrence of caffeine and adenosine in the brain

## RC Passage 2

Archaeology as a profession faces two major problems.
First, it is the poorest of the poor. Only paltry sums are available for excavating and even less is available for publishing the results and preserving the sites once excavated. Yet archaeologists deal with priceless objects every day.

Second, there is the problem of illegal excavation, resulting in museum-quality pieces being sold to the highest bidder.

I would like to make an outrageous suggestion that would at one stroke provide funds for archaeology and reduce the amount of illegal digging. I would propose that scientific archeological expeditions and governmental authorities sell excavated artifacts on the open market. Such sales would provide substantial funds for the excavation and preservation of archaeological sites and the publication of results. At the same time, they would break the illegal excavator's grip on the market, thereby decreasing the inducement to engage in illegal activities.

You might object that professionals excavate to acquire knowledge, not money. Moreover, ancient artifacts are part of our global cultural heritage, which should be available for all to appreciate, not sold to the highest bidder. I agree. Sell nothing that has unique artistic merit or scientific value. But, you might reply, everything that comes out of the ground has scientific value. Here we part company. Theoretically, you may be correct in claiming that every artifact has potential scientific value. Practically, you are wrong.

I refer to the thousands of pottery vessels and ancient lamps that are essentially duplicates of one another. In one small excavation in Cyprus, archaeologists recently uncovered 2,000 virtually indistinguishable small jugs in a single courtyard, even precious royal seal impressions known as melekh handles have been found in abundance - more than 4,000 examples so far.

The basement of museums is simply not large enough to store the artifacts that are likely to be discovered in the future. There is not enough money even to catalogue the finds; as a result, they cannot be found again and become as inaccessible as if they had never been discovered. Indeed, with the help of a computer, sold artifacts could be more accessible than are the pieces stored in bulging museum basements. Prior to sale, each could be photographed and the list of the purchasers could be maintained on the computer A purchaser could even be required to agree to return the piece if it should become needed for scientific purposes. It would be unrealistic to suggest that illegal digging would stop if artifacts were sold in the open market. But the demand for the clandestine product would be substantially reduced. Who would want an unmarked pot when another was available whose provenance was known, and that was dated stratigraphically by the professional archaeologist who excavated it?
Based on the Passage, answer the following questions:

1. The primary purpose of the passage is to propose
(A) an alternative to museum display of artifacts
(B) a way to curb illegal digging while benefiting the archaeological profession
(C) a way to distinguish artifacts with scientific value from those that have no such value
(D) the governmental regulation of archaeological sites
(E) a new system for cataloging duplicate artifacts
2. The author implies that all of the following statements about duplicate artifacts are true EXCEPT:
(A) A market for such artifacts already exists.
(B) Such artifacts seldom have scientific value.
(C) There is likely to be a continuing supply of such artifacts.
(D) Museums are well supplied with examples of such artifacts.
(E) Such artifacts frequently exceed in quality in comparison to those already cataloged in museum collections
3. Which of the following is mentioned in the passage as a disadvantage of storing artifacts in museum basements?
(A) Museum officials rarely allow scholars access to such artifacts.
(B) Space that could be better used for display is taken up for storage.
(C) Artifacts discovered in one excavation often become separated from each other.
(D) Such artifacts are often damaged by variations in temperature and humidity.
(E) Such artifacts' often remain uncatalogued and thus cannot be located once they are put in storage
4. The author's argument concerning the effect of the official sale of duplicate artifacts on illegal excavation is based on which of the following assumptions?
(A) Prospective purchasers would prefer to buy authenticated artifacts.
(B) The price of illegally excavated artifacts would rise.
(C) Computers could be used to trace sold artifacts.
(D) Illegal excavators would be forced to sell only duplicate artifacts.
(E) Money gained from selling authenticated artifacts could be used to investigate and prosecute illegal excavators

## 5. The author anticipates which of the following initial objections to the adoption of his proposal?

(A) Museum officials will become unwilling to store artifacts.
(B) An oversupply of salable artifacts will result and the demand for them will fall.
(C) Artifacts that would have been displayed in public places will be sold to private collectors.
(D) Illegal excavators will have an even larger supply of artifacts for resale.
(E) Counterfeiting of artifacts will become more commonplace

## RC Passage 3:

Federal efforts to aid minority businesses began in the 1960's when the Small Business Administration (SBA) began making federally guaranteed loans and government-sponsored management and technical assistance available to minority business enterprises. While this program enabled many minority entrepreneurs to form new businesses, the results were disappointing, since managerial inexperience, unfavorable locations, and capital shortages led to high failure rates. Even 15 years after the program was implemented, minority business receipts were not quite two percent of the national economy's total receipts. Recently federal policymakers have adopted an approach intended to accelerate development of the minority business sector by moving away from directly aiding small minority enterprises and toward supporting larger, growthoriented minority firms through intermediary companies. In this approach, large corporations participate in the development of successful and stable minority businesses by making use of government-sponsored venture capital. The capital is used by a participating company to establish a Minority Enterprise Small Business Investment Company or MESBIC. The MESBIC then provides capital and guidance to minority businesses that have potential to become future suppliers or customers of the sponsoring company.

MESBIC's are the result of the belief that providing established firms with easier access to relevant management techniques and more job-specific experience, as well as substantial amounts of capital, gives those firms a greater opportunity to develop sound business foundations than does simply making general management experience and small amounts of capital available. Further, since potential markets for the minority businesses already exist through the sponsoring companies, the minority businesses face considerably less risk in terms of location and market fluctuation. Following early financial and operating problems, sponsoring corporations began to capitalize MESBIC's far above the legal minimum of $\$ 500,000$ in order to generate sufficient income and to sustain the quality of management needed. MESBIC's are now emerging as increasingly important financing sources for minority enterprises.

Ironically, MESBIC staffs, which usually consist of Hispanic and Black professionals, tend to approach investments in minority firms more pragmatically than do many MESBIC directors,
who are usually senior managers from sponsoring corporations. The latter often still think mainly in terms of the "social responsibility approach" and thus seem to prefer deals that are riskier and less attractive than normal investment criteria would warrant. Such differences in viewpoint have produced uneasiness among many minority staff members, who feel that minority entrepreneurs and businesses should be judged by established business considerations. These staff members believe their point of view is closer to the original philosophy of MESBIC's and they are concerned that, unless a more prudent course is followed, MESBIC directors may revert to policies likely to re-create the disappointing results of the original SBA approach.

## Based on the Passage, answer the following questions:

1. Which of the following best states the central idea of the passage?
(A) The use of MESBIC's for aiding minority entrepreneurs seems to have greater potential for success than does the original SBA approach.
(B) There is a crucial difference in point of view between the staff and directors of some MESBIC's.
(C) After initial problems with management and marketing, minority businesses have begun to expand at a steady rate.
(D) Minority entrepreneurs wishing to form new businesses now have several equally successful federal programs on which to rely.
(E) For the first time since 1960, large corporations are making significant contributions to the development of minority businesses
2. According to the passage, the MESBIC approach differs from the SBA approach in that MESBIC's
(A) seek federal contracts to provide markets for minority businesses
(B) encourage minority businesses to provide markets for other minority businesses
(C) attempt to maintain a specified rate of growth in the minority business sector
(D) rely on the participation of large corporations to finance minority businesses
(E) select minority businesses on the basis of their location
3. Which of the following does the author cite to support the conclusion that the results of the SBA program were disappointing?
(A) The small number of new minority enterprises formed as a result of the program
(B) The small number of minority enterprises that took advantage of the management and technical assistance offered under the program
(C) The small percentage of the nation's business receipts earned by minority enterprises following the programs, implementation.
(D) The small percentage of recipient minority enterprises that were able to repay federally guaranteed loans made under the program
(E) The small number of minority enterprises that chose to participate in the program
4. Which of the following statements about the SBA program can be inferred from the passage?
(A) The maximum term for loans made to recipient businesses was 15 years.
(B) Business loans were considered to be more useful to recipient businesses than was management and technical assistance.
(C) The anticipated failure rate for recipient businesses was significantly lower than the rate that actually resulted.
(D) Recipient businesses were encouraged to relocate to areas more favorable for business development.
(E) The capitalization needs of recipient businesses were assessed and then provided for adequately

## 5. The author's primary objective in the passage is to

(A) disprove the view that federal efforts to aid minority businesses have been ineffective
(B) explain how federal efforts to aid minority businesses have changed since the 1960's
(C) establish a direct link between the federal efforts to aid minority businesses made before the 1960's and those made in the 1980's
(D) analyze the basis for the belief that job-specific experience is more useful to minority businesses than is general management experience
(E) argue that the "social responsibility approach" to aiding minority businesses is superior to any other approach

## RC Passage 4:

The majority of successful senior managers do not closely follow the classical rational model of first clarifying goals, assessing the problem, formulating options, estimating likelihoods of success, making a decision, and only then taking action to implement the decision. Rather, in their day-by-day tactical maneuvers, these senior executives rely on what is vaguely termed "intuition" to manage a network of interrelated problems that require them to deal with ambiguity, inconsistency, novelty, and surprise; and to integrate action into the process to thinking.

Generations of writers on management have recognized that some practicing managers rely heavily on intuition. In general, however, such writers display a poor grasp of what intuition is. Some see it as the opposite of rationality; others view it as an excuse for capriciousness.

Isenberg's recent research on the cognitive processes of senior managers reveals that managers' intuition is neither of these. Rather, senior managers use intuition in at least five distinct ways. First, they intuitively sense when a problem exists. Second, managers rely on intuition to perform well-learned behavior patterns rapidly. This intuition is not arbitrary or irrational, but is based on years of painstaking practice and hands-on experience that build skills. A third function of intuition is to synthesize isolated bits of data and practice into an integrated picture, often in an "Aha!" experience. Fourth, some managers use intuition as a check on the results of more rational analysis. Most senior executives are familiar with the formal decision analysis models and tools, and those who use such systematic methods for reaching decisions are occasionally leery of solutions suggested by these methods which run counter to their sense of the correct course of action. Finally, managers can use intuition to bypass in-depth analysis and move rapidly to engender a plausible solution. Used in this way, intuition is an almost instantaneous cognitive process in which a manager recognizes familiar patterns.

One of the implications of the intuitive style of executive management is that "thinking" is inseparable from acting. Since managers often "know" what is right before they can analyze and explain it, they frequently act first and explain later. Analysis is inextricably tied to action in thinking/acting cycles, in which managers develop thoughts about their companies and organizations not by analyzing a problematic situation and then acting, but by acting and analyzing in close concert.

Given the great uncertainty of many of the management issues that they face, senior managers often instigate a course of action simply to learn more about an issue. They then use the results of the action to develop a more complete understanding of the issue. One implication of thinking/ acting cycles is that action is often part of defining the problem, not just of implementing the solution.

## Based on the Passage, answer the following questions:

1. According to the passage, senior managers use intuition in all of the following ways EXCEPT to
(A) speed up of the creation of a solution to a problem
(B) identify a problem
(C) bring together disparate facts
(D) stipulate clear goals
(E) evaluate possible solutions to a problem
2. The passage suggests which of the following about the "writers on management" mentioned in paragraph 2?
(A) They have criticized managers for not following the classical rational model of decision analysis.
(B) They have not based their analyses on a sufficiently large sample of actual managers.
(C) They have relied in drawing their conclusions on what managers say rather than on what managers do.
(D) They have misunderstood how managers use intuition in making business decisions.
(E) They have not acknowledged the role of intuition in managerial practice
3. According to the passage, the classical model of decision analysis includes all of the following EXCEPT
(A) evaluation of a problem
(B) creation of possible solutions to a problem
(C) establishment of clear goals to be reached by the decision
(D) action undertaken in order to discover more information about a problem
(E) comparison of the probable effects of different solutions to a problem
4. It can be inferred from the passage that which of the following would most probably be one major difference in behavior between Manager X, who uses intuition to reach decisions, and Manager $Y$, who uses only formal decision analysis?
(A) Manager X analyzes first and then acts; Manager Y does not.
(B) Manager X checks possible solutions to a problem by systematic analysis; Manager Y does not
(C) Manager X takes action in order to arrive at the solution to a problem; Manager Y does not.
(D) Manager Y draws on years of hands-on experience in creating a solution to a problem; Manager X does not.
(E) Manager Y depends on day-to-day tactical maneuvering; manager X does not
5. The passage provides support for which of the following statements?
(A) Managers who rely on intuition are more successful than those who rely on formal decision analysis.
(B) Managers cannot justify their intuitive decisions.
(C) Managers' intuition works contrary to their rational and analytical skills
(D) Logical analysis of a problem increases the number of possible solutions.
(E) Intuition enables managers to employ their practical experience more efficiently.

## RC Passage 5:

Nearly a century ago, biologists found that if they separated an invertebrate animal embryo into two parts at an early stage of its life, it would survive and develop as two normal embryos.

This led them to believe that the cells in the early embryo are undetermined in the sense that each cell has the potential to develop in a variety of different ways. Later biologists found that the situation was not so simple. It matters in which plane the embryo is cut. If it is cut in a plane different from the one used by the early investigators, it will not form two whole embryos.

A debate arose over what exactly was happening. Which embryo cells are determined, just when do they become irreversibly committed to their fates, and what are the "morphogenetic determinants" that tell a cell what to become? But the debate could not be resolved because no one was able to ask the crucial questions in a form in which they could be pursued productively. Recent discoveries in molecular biology, however, have opened up prospects for a resolution of the debate. Now investigators think they know at least some of the molecules that act as morphogenetic determinants in early development. They have been able to show that, in a sense, cell determination begins even before an egg is fertilized.

Studying sea urchins, biologist Paul Gross found that an unfertilized egg contains substances that function as morphogenetic determinants. They are located in the cytoplasm of the egg cell; i.e., in that part of the cell's protoplasm that lies outside of the nucleus. In the unfertilized egg, the substances are inactive and are not distributed homogeneously. When the egg is fertilized, the substances become active and, presumably, govern the behavior of the genes they interact with. Since the substances are unevenly distributed in the egg, when the fertilized egg divides, the resulting cells are different from the start and so can be qualitatively different in their own gene activity.

The substances that Gross studied are maternal messenger RNA's - products of certain maternal genes. He and other biologists studying a wide variety of organisms have found that these particular RNA's direct, in large part, the synthesis of histones, a class of proteins that bind to DNA. Once synthesized, the histones move into the cell nucleus, where sections of DNA wrap around them to form a structure that resembles beads, or knots, on a string. The beads are DNA segments wrapped around the histones; the string is the intervening DNA. And it is the structure of these beaded DNA strings that guide the fate of the cells in which they are located. Based on the Passage, answer the following questions:

1. It can be inferred from the passage that the morphogenetic determinants present in the early embryo are
(A) located in the nucleus of the embryo cells
(B) evenly distributed unless the embryo is not developing normally
(C) inactive until the embryo cells become irreversibly committed to their final function
(D) identical to those that were already present in the unfertilized egg
(E) present in larger quantities than is necessary for the development of a single individual

## 2. The main topic of the passage is

(A) the early development of embryos of lower marine organisms
(B) the main contribution of modern embryology to molecular biology
(C) the role of molecular biology in disproving older theories of embryonic development
(D) cell determination as an issue in the study of embryonic development
(E) scientific dogma as a factor in the recent debate over the value of molecular biology
3. According to the passage, when biologists believed that the cells in the early embryo were undetermined, they made which of the following mistakes?
(A) They did not attempt to replicate the original experiment of separating an embryo into two parts.
(B) They did not realize that there was a connection between the issue of cell determination and the outcome of the separation experiment.
(C) They assumed that the results of experiments on embryos did not depend on the particular animal species used for such experiments.
(D) They assumed that it was crucial to perform the separation experiment at an early stage in the embryo's life.
(E) They assumed that different ways of separating an embryo into two parts would be equivalent as far as the fate of the two parts was concerned
4. It can be inferred from the passage that the initial production of histones after an egg is fertilized takes place
(A) in the cytoplasm
(B) in the maternal genes
(C) throughout the protoplasm
(D) in the beaded portions of the DNA strings
(E) in certain sections of the cell nucleus
5. It can be inferred from the passage that which of the following is dependent on the fertilization of an egg?
(A) Copying of maternal genes to produce maternal messenger RNA's
(B) Synthesis of proteins called histones
(C) Division of a cell into its nucleus and the cytoplasm
(D) Determination of the egg cell's potential for division
(E) Generation of all of a cell's morphogenetic determinants
6. According to the passage, the morphogenetic determinants present in the unfertilized egg cell are which of the following?
(A) Proteins bound to the nucleus
(B) Histones
(C) Maternal messenger RNA's
(D) Cytoplasm
(E) Non Beaded intervening DNA

## RC Passage 6:

In the two decades between 1910 and 1930, over ten percent of the Black population of the United States left the South, where the preponderance of the Black population had been located, and migrated to northern states, with the largest number moving, it is claimed, between 1916 and 1918. It has been frequently assumed, but not proved, that the majority of the migrants in what has come to be called the Great Migration came from rural areas and were motivated by two concurrent factors: the collapse of the cotton industry following the boll weevil infestation, which began in 1898, and increased demand in the North for labor following the cessation of European immigration caused by the outbreak of the First World War in 1914. This assumption has led to the conclusion that the migrants' subsequent lack of economic mobility in the North is tied to rural background, a background that implies unfamiliarity with urban living and a lack of industrial skills.

But the question of who actually left the South has never been rigorously investigated. Although numerous investigations document an exodus from rural southern areas to southern cities prior to the Great Migration, no one has considered whether the same migrants then moved on to northern cities. In 1910, over 600,000 Black workers, or ten percent of the Black workforce, reported themselves to be engaged in "manufacturing and mechanical pursuits," the federal census category roughly encompassing the entire industrial sector. The Great Migration could easily have been made up entirely of this group and their families. It is perhaps surprising to argue that an employed population could be enticed to move, but an explanation lies in the labor conditions prevalent in the South.

About thirty-five percent of the urban Black population in the South was engaged in skilled trades. Some were from the old artisan class of slavery-blacksmiths, masons, carpenters-which had had a monopoly of certain trades, but they were gradually being pushed out by competition, mechanization, and obsolescence. The remaining sixty-five percent, more recently urbanized, worked in newly developed industries - tobacco, lumber, coal and iron manufacture and railroads. Wages in the South, however, were low, and Black workers were aware, through labor recruiters and the Black press, that they could earn more even as unskilled workers in the North than they
could as artisans in the South. After the boll weevil infestation, urban Black workers faced competition from the continuing influx of both Black and White rural workers, who were driven to undercut the wages formerly paid for industrial jobs.

Thus, a move towards the North would be seen as advantageous to a group that was already urbanized and steadily employed, and the easy conclusion tying their subsequent economic problems in the North to their rural background comes into question.

## Based on the Passage, answer the following questions:

1. The author indicates explicitly that which of the following records has been a source of information in her investigation?
(A) United States Immigration Service reports from 1914 to 1930
(B) Payrolls of southern manufacturing firms between 1910 and 1930
(C) The volume of cotton exports between 1898 and 1910
(D) The federal census of 1910
(E) Advertisements of labor recruiters appearing in southern newspapers after 1910
2. In the passage, the author anticipates which of the following as a possible objection to her argument?
(A) It is uncertain how many people actually migrated during the Great Migration.
(B) The eventual economic status of the Great Migration migrants has not been adequately traced.
(C) It is not likely that people with steady jobs would have reason to move to another area of the country.
(D) It is not true that the term "manufacturing and mechanical pursuits" actually encompasses the entire industrial sector.
(E) Of the Black workers living in southern cities, only those in a small number of trades were threatened by obsolescence.
3. According to the passage, which of the following is true about the wages in southern cities in 1910?
(A) They were being pushed lower as a result of increased competition.
(B) They had begun to rise so that southern industry could attract rural workers.
(C) They had increased for skilled workers but decreased for unskilled workers.
(D) They had increased in large southern cities but decreased in small southern cities.
(E) They had increased in newly developed industries but decreased in the older trades.

## 4. The author cites each of the following as possible influences in a Black worker's decision to migrate north in the Great Migration EXCEPT

(A) wage levels in northern cities
(B) labor recruiters
(C) competition from rural workers
(D) voting rights in northern states
(E) the Black press
5. The primary purpose of the passage is to
(A) support an alternative to an accepted methodology
(B) present evidence that resolves a contradiction
(C) introduce a recently discovered source of information
(D) challenge a widely accepted explanation
(E) argue that a discarded theory deserves new attention

## RC Passage 7:

Let us go then, you and I, When the evening is spread out against the sky like a patient etherized upon a table; Let us go, through certain half-deserted streets, The muttering retreats Of restless nights in one-night cheap hotels And sawdust restaurants with oyster-shells: Streets that follow like a tedious argument Of insidious intent To lead you to an overwhelming question. . . Oh, do not ask, "What is it?" Let us go and make our visit.

In the room the women come and go Talking of Michelangelo.
The yellow fog that rubs its back upon the window-panes
The yellow smoke that rubs its muzzle on the window-panes Licked its tongue into the corners of the evening Lingered upon the pools that stand in drains, Let fall upon its back the soot that falls from chimneys, Slipped by the terrace, made a sudden leap, And seeing that it was a soft October night Curled once about the house, and fell asleep.

And indeed there will be time For the yellow smoke that slides along the street, Rubbing its back upon the window-panes; There will be time, there will be time To prepare a face to meet the faces that you meet; There will be time to murder and create, And time for all the works and days of hands That lift and drop a question on your plate; Time for you and time for me, And time yet for a hundred indecisions And for a hundred visions and revisions Before the taking of a toast and tea.

In the room, the women come and go Talking of Michelangelo. And indeed there will be time

To wonder, "Do I dare?" and, "Do I dare?"
Time to turn back and descend the stair, With a bald spot in the middle of my hair- [They will say: "How his hair is growing thin!"] My morning coat, my collar mounting firmly to the chin, My necktie rich and modest, but asserted by a simple pin- [They will say: "But how his arms and legs are thin!"] Do I dare Disturb the universe? In a minute there is time for decisions and revisions which a minute will reverse.

For I have known them all already, known them all; Have known the evenings, mornings, afternoons, I have measured out my life with coffee spoons; I know the voices dying with a dying fall Beneath the music from a farther room. So how should I presume?

## Based on the Passage, answer the following questions:

1. Which of the following meanings can be inferred from the lines " 0 I dare Disturb the universe?"
(A) The author is referring to his bright future.
(B) The author fears that he will cause some major upheaval in world.
(C) The author refers to the 'status quo' in which he is in.
(D) The author expresses his feeling of being pinned against a wall.
(E) The author is apprehensive about his last days.
2. What, according to the passage, is the reason for the author's optimism?
(A) That the women are talking of Michelangelo.
(B) That the yellow fog rubs upon the window-panes.
(C) That it was an October night.
(D) That there will be moments for everything.
(E) That the falling soot made a sudden leap.
3. In the first ten lines of the passage, the author embodies which of the following with human attributes?
(A) toast
(B) restaurants
(C) intent
(D) retreats
(E) arguments
4. In the passage, the evening is compared to:
(A) The spreading sky
(B) The anesthetized patient
(C) Wicked people
(D) The deserted streets
(E) A walk in the streets

## UNIT - 4

## COMMUNICATION

- Communication: meaning, types and characteristics of communication.
- Effective communication: verbal and non verbal. Inter-cultural and group communications, classroom communication
- Barriers to effective communication.
- Mass -media and society.


## Communication

## Introduction :

Communication is simply the act of transferring information from one place, person or group to another. Every communication involves (at least) one sender, a message and a recipient. This may sound simple, but communication is actually a very complex subject. The transmission of the message from sender to recipient can be affected by a huge range of things. These include our emotions, the cultural situation, the medium used to communicate, and even our location. The complexity is why good communication skills are considered so desirable by employers around the world: accurate, effective and unambiguous communication is actually extremely hard.

## Meaning of Communication

Commnication from latin word Communicare ,meaning "to share" is the act of developing meaning among entities or groups through the use of sufficiently mutually understood signs, symbols, and semiotic conventions.

Oxford English Dictionary, communication, n. The imparting or exchanging of information by speaking, writing, or using some other medium. ...The successful conveying or sharing of ideas and feelings.

## Communication Process



A communication therefore has three parts: the sender, the message, and the recipient. The sender 'encodes' the message, usually in a mixture of words and non- verbal communication. It is transmitted in some way (for example, in speech or writing), and the recipient 'decodes' it. Of course, there may be more than one recipient, and the complexity of communication means that each one may receive a slightly different message. Two people may read very different things into the choice of words and/or body language. It is also possible that neither of them will have quite the same understanding as the sender.

In face-to-face communication, the roles of the sender and recipient are not distinct. The two roles will pass back and forwards between two people talking. Both parties communicate with each other, even if in very subtle ways such as through eye-contact (or lack of) and general body language. In written communication, however, the sender and recipient are more distinct.

## Types of Communication

Intrapersonal Communication: It is talking to oneself in one's own mind. Examples are soliloquies or asides in dramatic works.
Interpersonal Communication: It is the exchange of messages between two persons. For example, a conversation, dialogue, or an interview in which two persons interact (others may also be present as audience). An author communicates interpersonally with his reader, who is always present as a silent audience in the author's mind while he writes. A letter too is an example of interpersonal communication between the writer and the person to whom it is written.
Group Communication: It can be among small or large groups, like an organization, club or classroom, in which all individuals retain their individual identity.

Mass Communication: It occurs when the message is sent to large groups of people, for example, by newspaper, radio, or television. In this process, each person becomes a faceless individual with almost no opportunity for personal response or feedback.

## Based On the basis of the medium

Verbal Communication: It means communicating with words, written or spoken. Verbal communication consists of speaking, listening, writing, reading, and thinking. It may further be classified as Oral or Written Communication.

Non-verbal communication: It includes using of pictures, signs, gestures, and facial expressions for exchanging information between persons. It is done through sign language, action language, or object language. Non-verbal communication flows through all acts of speaking or writing. It is a wordless message conveyed through gestures (sign), movements (action language), and object language(pictures/clothes) and so on. Further non-verbal communication can be identified by personal space, sense of smell and time .

Meta Communication: Here the speaker's choice of words unintentionally communicates something more than what the actual words state. For example, a flattering remark like "I've never seen you so smartly dressed" could also mean that the regular attire of the listener needed improvement.

Formal Communication: A formal channel of communication can be defined as a means of communication that is formally controlled by managers or people occupying positions in an organization. The communication flows through formal channels, that is, officially recognized positions along the line in the organization. This ensures that the information flows orderly, timely, and accurately. Any information, decision, memo, reminder etc. will follow this path.

Informal Communication: Side by side with the formal channel of communication every organization has an equally effective channel of communication that is the informal channel. It is not officially sanctioned, and quite often it is even discouraged or looked down upon. But, then, it is very much there, and has been given the name 'grapevine' precisely because it runs in all directions-horizontal, vertical, diagonal. As the management experts put it, "it flows around water coolers, down hallways, through lunch rooms, and wherever people get together in groups".

Downward Communication: The Communication that flows from Top to Bottom is known as downward communication. Any organization has an inbuilt hierarchical system, and in that, in the first instance, communication invariably flows downwards.

Upward Communication: The Communication that flows from bottom to top, which is from lower hierarchical level to higher level, is called Upward Communication. The main function of upward communication is to supply information to the upper levels about what is happening at the lower levels. It is just the reverse of the previous dimension.

Lateral Communication : Lateral communication involves communication among persons who do not stand in hierarchical relation to one another. While recent trends to flatten organizations have enhanced the importance of lateral communications, studies on lateral
communication still lag behind those on vertical communication. One fairly limited study found rather high levels of satisfaction ( 85 percent) with lateral communication among human resource managers (Frank1984), but lateral communication across managers of dissimilar functional divisions, while often cited as a major source of organization dysfunction, has not been subject to much empirical research. It has been assumed that lateral communication at the worker level is less problematic, at least within a functionalarea.

Diagonal Communication: Diagonal communication refers to communication between managers and workers located in different functional divisions (Wilson 1992). Although both vertical and horizontal communication continue to be important, these terms no longer adequately capture communication needs and flows in most modern organizations. The concept of diagonal communication was introduced to capture the new communication challenges associated with new organizational forms, such as matrix and project-based organizations.

## Characteristics of Communication

Communication involves at least two persons: Communication involves at least two persons-the sender and the receiver. The sender sends the message and is known as the communicator. The receiver receives the message and is known as communicate.

Communication is a two way process: Communication is essentially a two way process. It does not merely means sending and receiving messages. It is not complete unless and until the message has been understood by the receiver in the same sense.

Purpose of communication: Message is a Must. A message is the subject matter of communication. e.g., the contents of the letter or speech, order, instructions or the suggestions. A communication must convey some message. If there is no message there is no communication. The basic purpose of communication is to create an understanding. The receiver should understand the message sent and should response accordingly.

Form of communication: Communication may take several forms e.g. order, instruction, report, queries etc. It may be verbal or written. It may be formal or informal.

Scope of communication: Communication pervades all human relationship. It is essential in all type of organizational and at all levels of management.

Communication is a dynamic process: Communication is influenced by the mood and thinking of the sender and receiver. The way a message is accepted depends upon the fact that which of the fine sensory organs of the receiver is active at that time.

Communication is much more than words: Communication is not merely sending or receiving facts, expressed in words. Communication May be Written, Oral or Gestural. It also involves ideas and emotions.

A lot of communication is done through signs, symbols and gestures.
Communication's primary purpose is to motivate a response: The primary purpose of communication is to motivate response or influence human behaviour. There is no doubt that motivation comes from within but communicator can also motivate people by good drafting of message, proper timing of communication, etc. To create understanding, communication should be relevant to the situation. It must always be remembered that communication is a means of motivating and not an end itself.

Communication is conversational: Communication sets up a link between facts, ideas, and thus helps the communicator and communicates to progress logically.

Communication is an interdisciplinary science: Communication to be effective derives knowledge from several sciences like-anthropology (study of body language), sociology (study of human behaviour), psychology (study of attitude) etc

Communication may be formal or informal: Formal communication follows the formal channels provided in the organisation structure. For example, the Managing Director communicates with the departmental heads, say Finance Manager, finance manager communicates to deputy finance manager, the deputy finance manager with accounts officer and so on. In simple words, in informal communication, there is no direct communication between the Managing Director and the accounts clerks. Informal communication flows from informal channels of communication which are not provided in the organisation structure. These channels develop among members because of personal contacts through working with each other.

It flows up and down and also from side to side: Communication flows downward from a superior to subordinate and upward from subordinate to a superior. It also flows between two or more persons operating at the same level of authority.

## Effective Communication

Seven C's of Effective Communication: These are the Seven terms, starting with the letter C, which make communication more understandable, valuable and effective.

| C's | Relevance |
| :--- | :--- |
| Credibility | Builds trust |
| Courtesy | Improves relationships |
| Clarity | Makes comprehension easier |
| Correctness | Builds confidence |
| Consistency | Introduces stability |
| Concreteness | Reinforces confidence |

Four S's of Communication: Four terms starting with letter S, which add to the value of the message in Communication

## Sincerity

Simplicity

## Shortness

## Strength

## Communication Models

Shannon- Weaver Model: In the year 1949 Cloude Shannon, an electrical engineer and Warren Weaver propounded a mathematical model of communication. This model particularly explains electronic communication in a simple linear way which is easily understandable.


## Shannon-Weaver's Model of Communication

Information Source: - It is the beginning of the process. It represents some purpose on the part of sender.
Message:- It is the information passing between sender and receiver in the communication process.

Transmitter: - The sender of message is an encoded form is known as transmitter.
Noise Source: - The model recognizes the potential of noise in distorting the message while transfer through channel.
Reception: - He is the person to whom information is send. He decodes the information.
Destination: - It is the end of the communication process.

Murphy's Model:This communication process model is propounded by three writers. According to this model; there are six components of communication process :


Context: - Context is a broad field that includes country, culture, organization, internal \& external cause of action and every message weather oral or written begins with context.

Sender-Encoder: - The second- encoder used symbols, usually words, to express the message and create desired response.

Message: - The message is the core idea the sender wishes to communicate. It consists of both verbal and non-verbal symbols.

Medium: - It is the channel through which a message is communicated. It can be printed word, e-mail, sound or gesture.

Receiver- decoder:- The receiver/listener is the person who receives the message and decodes it.

Feedback: - It can be oral or written. It can be an action such as receiving an ordered item. Sender needs feedback in order to determine the success or failure of the communication.

Thill and Bovee Model:According to Thill and Bovee communication model, business communication is more than a single act. It is a chain of events consisting of five phases linking sender and receiver.

Idea: - The sender has an idea. In the process of conceiving an idea about the real world, the sender leaves out many things but assumes some things. This means idea in the mind of sender is a simplification of the real world.

Message: - The idea in the mind of sender is transformed into words and thus becomes a message. The message may be expressed in many ways.

Message is transmitted: - The 3rd step in the process is physical transmission of the message through verbal or non-verbal channel, from sender to receiver.

Receiver gets Message: - For communication to occur, the receiver has to get the message, and understand the message and store the message mentally.

Feedback: - The receiver reacts after receiving the message and sends feedback. Feedback is a key element in the communication process because it enables the sender to evaluate the effectiveness of the message. Then the process is repeated until both parties have finished expressing themselves.

## Barriers to Communication

Communication is not always successful. Certain barriers in communication affect the clarity, accuracy and effectiveness of the message. These barriers hamper the growth of communication and relegate it to the status of a conversation where feedback is not expected. If either the speaker or the listener has problems in adjusting his frequency with the co-interactants, barriers would automatically be erected.

Several things can prevent the message from reaching the intended recipient or from having the desired effect on the recipient. There may be some fault in the communication system which may prevent the message from reaching. Some of these defects are in the mechanical devices used for transmitting, that is, the medium; some are in the tools we use for communicating, that is, language or other symbols used for encoding; Some are related to the sender or the receiver.

Semantic barriers: Different people assign different meanings to one specific message. This is due to the problems with meaning, significance, and the sending and reception of the meaning and content of the massage.

Organizational barriers: This type of barrier develops due to the problems with physical distance between members with respect to their functional specialization of tasks, power, authority and status relationship, values held, and ownership of information.

Interpersonal barriers: These barriers also develop in the process of communication. They are based upon the relationships, values held, and attitudes of the participants in the process of communication.

Individual barriers: These are also called psycho-sociological barriers. The problem of this barrier arises due to differences in individual competencies to think and act, which would include physical aliments or handicaps. It is also because of individual skills in receiving and transmitting information, which would include poor listening and improper reading skills and adverse psychological conditions.

Cross Cultural (geographic) barriers: Culture is a shared set of values and attributes of a group. The communication barriers are also seen because of time, geographic locations, and the effects of time upon reception of the message and other cross cultural factors.

Physical Barriers/Channel and media barriers: The effectiveness and accuracy of communication is also affected by the physical barriers like distance, noise or channel and the media used in the process. In this category, problems that confront the media used in the process. In this category, problems that confront the issue of how best to communicate a message are included. (For example, it is best to transmit a massage face to face rather than in writing).

Technological barriers: They are barriers which arise due to technological advancements in the field of communication. Technology generates lot of information, which is beyond the capacity of the recipient. Further, the media advancements on account of technological process increase the barriers. The ideas and massage have to reach from the transmitter to receive in the same sense. If it does not happen, it is on account of barriers in communication.

## EFFECTIVE CLASSROOM COMMUNICATION

## Introduction

Communication is a very important component of the teaching profession. Without it, it would be impossible to teach or learn.

At the end of this chapter, you should be able to:
Explain the four general functions of classroom communication
Explain the difference between traditional and current views of communication.
Explain how communication is used to maintain proper classroom management
Construct quality open-ended questions
Describe the role of verbal and non-verbal communication in the classroom
Discuss the characteristics of effective teachers in the classroom

## Functions of classroom communication

Communication in our lives or in any profession is meant to serve a set of functions. This chapter has identified the following four functions as being relevant for classroom communication. Even so, they are not unique to teaching and learning. These are:

## Understanding and insight

Teachers teach in order to assist their learners understand subject content as clearly as possible. The idea that a learner ought to develop deep insights regarding what they study is key. Deep learning is different from surface level learning. In addition to understanding content, teachers and learners need to understand themselves and each other. Teachers use their understanding of learners to deliver content in ways that meet individual needs. Both teachers need to also understand their environment as this understanding is also suitable for effective learning. Using communication to ask questions that foster reflection is useful in promoting understanding

## Persuasion and influence

The whole process of teaching and learning is one of trying to influence another person. Teachers try to persuade learners and every teacher will influence their learners whether they like it or not. The important question then becomes: what do you say or do in your classroom in order to create a positive influence. Persuasion can take the form of direct words used intentionally to get a learner to do work, answer a question, change behaviour and so forth. Learners need to taught explicitly how they can use communication to influence the teacher, other learners and others in the community. Writing is also a powerful way of influencing others. You may want to think about this: How can your learners write with the intention to persuade and influence (you the teacher) and other relevant audiences? Can you think of how writing influences the examiner when grading tasks?

## Promoting learning skills

Traditionally, teaching has been more about the teacher dominating the classroom with teacher talk. Today emphasis is shifting on helping learners become responsible for their own learning. Learners develop their learning skills when a teacher allows them time to speak more, read texts and discuss in groups as well participate in writing tasks that involve summarizing key ideas from what the teacher says or from their reading. Effective communication is a strong enabling factor for learning so the teacher should promote the communication skills of learners. Modeling the learning behaviour you would want your learners to copy is very important. This is done by how you research for new ideas and how you ask questions that require serious attention from learners.

## Initiate and maintain relationships

Classroom teaching is interpersonal as well as social in that learners learn best when they have a strong sense of belonging. The teacher should be interested in using communication to
promote a social climate where learners work collaboratively. Every learner should feel valued and respected by the teacher and other learners. You can imagine a classroom where positive human connection was absent. Learning would not occur. Communication in this case should minimize the need for competition and focus on care and support for others. Within this function many educational goals can be supported such as unity, love, cultural diversity, integrity, etc.

These functions apply in many different areas of human endeavour and as such communication skills are regarded as top on the list of $21^{\text {st }}$ century skills Every education system is now challenged to see to it that their development (ref to the $21^{\text {st }}$ Century Skills and Competency Based Curriculum for Kenya) is given attention.

## The communication process

Up to the late fifties, communication was viewed as a one way process. During this time, the injection model was used to show how the process happened. You should be able to see how simplistic this way of looking at communication is. It fails to account for such elements of the process as feedback, cultural context or the complexity that emanates from the needs, abilities and sometimes hidden and conflicting goals of participants.

The traditional view has tended to look at messages as though they were objects being moved from person to person. Words are looked at as though they have fixed meanings of their own which we now know is not the case.

The current understanding instead is that words or concepts are given meaning through a negotiated process where prior knowledge, experiences, interests, abilities and the social and cultural contexts of participants play a key role. This current view is very much in line with the contemporary views of how learning happens. The constructivist view of learning developed by Vygotsky (1978) and supported by (Bruner, 1973) has greatly popularized learning as an active, interactive and creative process through which meaning is constructed rather than just being accepted as having come from an authority. Three principles underlie the constructivist theories of learning:

Instruction must be presented in a structure that can be easily grasped by learner
Instruction must be concerned with creating a conducive learning environment that makes students willing to learn

Instruction should challenge the learner to go beyond what they already know. A major weakness with teacher-centered teaching is that learners are not challenged to explore implications of many of the facts they know. Take a familiar topic and challenge yourself to think critically about facts you very well know. Words such as nutrition, poverty, healthy, community service and others can gain new meaning when critically examined.

## Two key roles of classroom communication

There are two main roles of classroom communication: classroom instruction and classroom management.

## Classroom instruction

Explaining is a major form of communication in the classroom and it is combined with giving examples, asking questions as well as responding to student answers. The importance of preparation and lesson planning which have already been emphasized in the chapter on Teaching Documents cannot be over-emphasized. Structuring the content in small clear steps and moving from known to the unknown is very useful for learners. Communicate always in a manner that shows that the goal of your teaching is to show how knowledge is created progressively from the simple to the complex. Effective communication requires use of a multi-sensory approach that targets as many senses as possible.

Notice here that as a teacher, it is your responsibility to help your learners become better at learning and you achieve this by allowing them time to do certain tasks individually, in pairs, small groups or as whole class. Instructing a class should not be equated to explaining all through. Present information in ways that foster habits of mind such as imagination, creativity, critical thinking and problem-solving.

## Communication and classroom management

Classroom management or control is used by a teacher to ensure that conditions that promote effective and efficient learning are available. Whether you like it or not, you will encounter classrooms where some of your learners will disrupt learning in one way or other. Disruptive behavior or simply student misbehavior has to be handled skillfully and effective classroom communication will help any teacher prevent or deal with inappropriate behavior.

There are many strategies of maintaining classroom control as research in the area of classroom management will reveal. These strategies fall under four general approaches. Let us look at them:
i) behavior modification
ii) promoting socioemotional learning environment
iii) Initiating and managing group process
iv) the authoritative approach.

You need to realize that research does not seem to favour any one particular approach. Instead, a teacher is advised to carefully blend approaches in order to meet the realities of each classroom situation.

## Behaviour Modification

The assumption here is that the behavior you have to deal with perhaps has been a reality of your classroom even before you took over the class. There is also the possibility that some students will start behaving improperly after you take over the class. The question then is: what kind of teacher communication behavior can assist in changing badly behaved students to well behaved ones? The behaviourist approach based on experimental psychology by B.F. Skinner recommends a consistent and systematic approach of rewarding (reinforcing using words such as "good", "well done") for appropriate student bahaviour and removing rewards (punishment) for misbehaviour. This is the traditional approach to dealing with misbehavior. It is rather simplistic and compared to other approaches, it is considered least effective especially when dealing with adolescents. You need to bear in mind that an adolescent can tell when he is being manipulated using some reward and may not cooperate.

## Socio emotional learning environment

This is an approach that believes that classroom control can be established and maintained by use of positive communication that results in good interpersonal relationships. It views the classroom as a place where learners value the feeling of being connected to the teacher and to other learners. The classroom is viewed as a community where each learner has a sense of belonging and feels supported. The teacher projects attributes of one who is real, accepting and empathetic. Every student matters and teacher communication focuses on promoting the learner's sense of belonging, worthiness and success. The teacher creates this climate by viewing teaching and learning as social in nature and so creates social time where the teacher and learners interact freely and learners are encouraged to care and support one another. The teacher pays attention to the needs of each learner and will devote extra time for those with issues. This makes all learners willing to participate in lessons.

The teacher makes learners busy and engaged and ensures their learning is meaningful. Increasing student engagement through working on meaningful tasks is considered the most effective way to manage a class. You will be able to accomplish this through careful planning of learner activities. The teacher is also able to establish control by conveying enthusiasm and confidence. $\mathrm{He} /$ she checks the mood of the learners and responds appropriately. He clearly communicates to the learners what is expected of them and repeats instructions. Learning is made fun by careful use of humour, anecdotes, novelty and challenging tasks. Praise is used extensively through direct or indirect verbal comments or by use of non-verbal channels and rewards. The teacher maintains his composure always and does not rely on verbal outbursts when a student or the class is out of control.

At this point, you may want to think of appropriate things you may need to say as well as how you can communicate non-verbally to cultivate a warm learning climate. Think also of what
you should not say or do. In communication, teachers do not just share ideas that promote subject understanding, they also communicate their feelings and attitudes towards their learners. How can you communicate appropriate feelings and attitudes effectively? How can you project the image that your outward actions reflect what you really feel? That means if you show care, this is because you are caring and not a pretender!

Let us pause and ask: exactly what kind of statements or non-verbal actions can a teacher make that can promote good relationships in class. Make a list of as many as you can think of.

## Initiating and managing group process

There are two types of communication strategies that are required of the teacher in order to manage the groups well. The first one has to do with ensuring that the group has a challenging task (task -oriented communication). How you frame the question will matter a lot in this stage. Learners will stay on a task if it is challenging and meaningful and if it is within their level. The second type of communication ensures individual members have distinct roles and each learner has a part to play and the group is working smoothly. This is maintenance-oriented communication. The first is cognitive and it means that groups stay on a task when it is cognitively challenging, while the second is affective and it means that once a task is given, the feelings of the learners are monitored to ensure they respond as required.

Your role in task maintenance is to monitor learner reactions and provide support through prompts, clarifying, repeating instructions or providing more resources or time. You should not leave learners stranded or distracted if the task is not of their level.Give the groups confidence by accepting their contribution while you also correct as necessary.Overall, the teacher should emerge as one who uses communication to get answers regarding students' feelings and thoughts and uses the same to ensure that dominant feelings are those that support accomplishment of group tasks. Learning in groups is useful in helping learners develop their communication and independent learning skills. This happens only with effective communication of tasks and how they are carried out.

You may want to ask yourself at this point: How can you use words and non-verbal cues to persuade and influence your students( especially those less enthusiastic or are slow in task) during group processes?

## Authoritative approach

The authoritarian style of classroom management is one in which the teacher yields very high control of the class but where there is very low learner involvement. The teacher is controlling, is very strict and inflexible. His focus is on content and not the feelings of learners or their problems. The learners with the authoritarian teacher obey the rules but inwardly they loath such a teacher. The democratic and laisses-faire approaches leave students on their own due to very
low level of teacher control. In both approaches learning may not occur as teacher guidance is often lacking. The authoritative teacher on the other hand is less controlling but his/her class is very highly involved. $\mathrm{He} /$ she is caring and listens to students. The teacher is firm but fair and is flexible and operates with a clear set of rules and consequences for misbehavior. $\mathrm{He} /$ she listens to students to weigh the circumstances whenever rules are broken before applying the consequences. He is consistent in his application of rules and in use of consequences. The students like this teacher because he gives them a choice in how they should behave. He makes them responsible and accountable for the choices they make. There are few behaviour problems in this type of class.

NB: How a teacher conducts himself/herself matters if he/she will have a well-controlled class.In the next section we want to look at the characteristics of effective teachers. But, before you continue, think about the four approaches to classroom management and check and decide how they help the teacher meet the four functions of communication.

Let us now look at some characteristics that define an effective teacher:
The teacher's attitude is by far the most important characteristic and how he conducts himself verbally and non-verbally is shaped by how he/she views himself/herself as well as the attitude towards the learners and even the subject. A positive attitude is vital in surmounting odds that may come up with the job of teaching. The question, however is, how do you communicate your positive attitude to others?

An effective teacher is learner-needs focused or to put it simply learner-centered and is intrinsically motivated to see to it that he communicates a sense of accomplishment to each learner. All learners are defined by three sets of needs: need to feel they can succeed and that he is supported do so; need for community where the teacher makes each learner to feel he is part of a caring community or team and thirdly; need for active learning whereby the teacher ensures learners are enabled using appropriate tasks to become active participants and not passive recipients of information.

The teacher is firm and fair. Teachers who take student needs into account are often perceived to be fair and objective. They earn respect from their learners and are better able to establish effective classroom routines and classroom management. They see misbehavior as resulting from unmet learner needs rather than to do with personality problems of the learner.Before you condemn a learner for misbehavior think about this.

Effective teachers are patient with learners. They are usually in control and give learners ample time to learn and practice. They do not move with the syllabus. They take student needs into account as individuals and present subject content and classroom tasks to match the different needs of learners. A Competency Based Curriculum is in favour of such an approach.

Given what we have said so far, would you agree that behaviour problems can be reduced by learner-centered approaches to learning?

## Use of questioning technique and feedback

The quality of the questions asked determines a teacher's level of success with the lesson. Quality questions promote deep learning as learners apply reasoning and analytical approaches to the facts they know.There are two types of questions: closed type and open-ended. Closed questions fall at the bottom of the hierarchy of knowledge (see Blooms taxonomy) and deal more with recall of facts. An effective teacher uses these questions sparingly and shows greater interest in higher order open-ended questions. Higher order questions challenge students to think critically and creatively. The goal of quality questions is not to come up with one correct answer but to promote multiple ways of thought. Thus the thinking processes by which the answer or conclusion is reached becomes more important than the answer itself.

Quality questions are aimed at checking for understanding or comprehension and provide multiple ways for students to respond. These types of questions are known as Socratic questions. The focus of these questions is how students discover answers, how they can comprehensively describe a problem or issue, analyze concepts, probe reasons and predict the implications or consequences given certain scenarios. The method aims at getting learners to be systematic, deep and logical thinkers. This method is learner-centered and concerns itself more with the learners' participation and how they monitor their thinking (metacognition). In this case, the teacher puts on an ignorant mindset in order to force learners to assume the highest level of knowledge. The teacher gives learners space to correct their thinking and to experiment with alternative courses of action or ideas.In being supported to check how they are thinking, the students learn to distinguish between logical and faulty thinking.Problem-based and project-based are high on the category of quality questions due to their demand for application of complex knowledge, laws, concepts and principles

Effective questioning techniques take attention from you the teacher to your learners and should encourage discussion either in small groups or by the whole class. They reveal your level of interest in the learners as well as the subject and by using such questions, you get an opportunity to show them that you value not just what they learn but how they learn it. The process of getting answers to complex questions need not end in class and teacher allows time for learners to keep reflecting even after the lesson. Students are challenged to look for more ideas on their own and to challenge their current points of view with future thinking. A good teacher therefore is to be judged not by his answers but by the questions he/she asks. The important thing to note here is that a teacher's responsibility is to develop the art of asking quality questions. Students become expert learners by also learning how to ask the right questions themselves.

How a teacher responds to student answers requires skillful communication. In providing feedback, you should encourage learners to talk by responding positively to failure. Ask them to clarify, respond in ways that fire their curiosity and work with them to look for an answer, probe their answers and guide them towards alternative points of view.Portaray the impression that you are all learning. Encourage sharing of different perspectivesboth orally and in writing and relate classroom discussion to the real world. When you give feedback, aim at reinforcing certain kinds of student responses and behaviour. Use the learners names when you ask for feedback.

Feedback should be given both verbally and non-verbally and also directly and indirectly. Indirect feedback is given to the student in a manner that may not use the learner's name and the teacher directs it to the whole class. You say, "I can see a good number of you have taken the advice I gave last time... I am pleased with the way some of you are working on this problem. You have the right resources on the table...Some of you are now asking real good questions.." This is, of course, in addition to the direct one to a specific learner. Learners can also give feedback to their neighbours. Summary of key points using two sentences can be used from time to time. In the conclusion ask all learners to make a two sentence summary of what your lesson was about.

Feedback is not just for inside the classroom. You can also time feedback and give it outside the class to make a not so well behaved or disengaged student look good to somebody that matters such as another teacher, a parent or the school head. Look for an opportunity to catch them doing something good and surprise them. You could say, "Peter you surprise me...I didn't know you are so good with that..."'Learners will work hard if they get feedback for their effort. Remember that just because learners look bored during your class time and does not mean everything on earth bores them. Interview some of those who look bored and work together to make their learning enjoyable. Learners expect positive feedback when they succeed and the teacher should use positive communication that encourages the learner, "good", 'well done, "try harder", "ooh you surprised me", "let's work together later and improve on this" are all motivating to the learner. Negative communication should be avoided at all times and instead, teachers should use poorly done work as opportunity to support learner. May be you can say, " 1 am available to help you with this".

The teacher needs to use student feedback as a way of improving how to teach more effectively. A teacher needs to know what learners think about the way he conducts various aspects of teaching. Few teachers do this, yet, it is one way of showing learners you are interested in ensuring that their needs matter to you. Are you willing to hear the truth from your learners about how you teach and how you can deliver lessons more effectively? You can get feedback through asking openly or sometimes by interviewing some of the students in private. As a teacher, you could also ask for peer evaluation from another teacher. The idea being communicated to your learners is that even teachers still continue to learn. This is a good strategy for building trust
and reducing classroom management problems by building rapport. Feedback should help deliver one message: it is alright to fail. Failure then becomes a means to learn.

The following guidelines will be useful in regard to asking questions and using feedback:
Pose questions that invite a range of perspectives agree/disagree, for/against or call for debate.

Engage all learners even those not willing to volunteer
Do not punish for any wrong answer
Build from simple to complex
Take a "straw vote" (answer up if you agree with Jane) and ask a few of those who agree to justify and the same for those who disagree.

Frown a bit an ask "Are you sure?"
Ask if there is another way to solve the problem and also ask learner to explain the actual process of arriving at an answer

If a student cannot answer a difficult question, ask a contingency back up question on a lower level

Refuse to accept responses that are not audible to all learners and do not entertain mixed chorus answers

Give praise for partially correct responses as the whole class works towards reaching the correct answer to complicated questions.

Do not abandon a question because it is seems hard. Start your learners off with little hints until finally the students themselves give the answer.

NB: How students think or the mental processes by which they arrive at answers is what the teacher needs to focus on and not the correct answer per se. The term "metacognition" refers to a great strategy that both teacher and learner can use to promote better thinking. Research more on the term and see how it applies to you as a teacher or as a learner.

## Verbal and non-verbal strategies

You will communicate in your classroom using two major channels: verbal and non-verbal. Verbal communication refers to your spoken and written words while non-verbal communication refers to a variety of aspects that include facial expression, gestures, voice, proximity to learner, time, as well as your mode of dress. Teachers rely mostly on verbal communication but in order for them to be effective, they have to remember that when used properly, non-verbal communication is a powerful auxiliary of verbal communication. This means that verbal communication needs the support of non-verbal behavior in order to be effective. In order to
fully understand how these two types of communication operate in the classroom, we shall look at each one in turn.

## Verbal communication

Itrefers to any communication with your learners where words are used. This means that as a teacher, you will use both spoken and written words to deliver messages to your learners. In using spoken words, the following guidelines are useful:

Your voice is a very important aspect of verbal communication. It has variouscharacteristics that ultimately determine if it is of high or low quality. The first of these is intensity or volume level. How loud you want your voice to be is situational. As a teacher, you have to judge the appropriate volume for each situation. Remember that if your volume is low when it ought to be loud, you will be perceived as shy. On the other hand, if you speak too loudly with a small group, you will be perceived to be aggressive. Keeping your volume at an appropriate level makes you sound confident.

The second characteristic is intonation or voice inflection. Your voice has a tendency to rise and fall. A good example can be heard when we are asking a question or making a statement. Similarly, falling and rising happens as we try to fulfil a number of intentions in our speech. Teachers just like other speakers are literary actors and they use voice to express various states of mind. Think of how a good story teller uses intonation in order to make emphasis, to express astonishment or a surprising end. As a teacher, you should avoid use of monotone as this would be unnatural and ineffective.

Rate is the other element in verbal communication. Simply put, it refers to how fast or how slow you speak. Some people speak too fast in situations where they should be slower and viceversa. Research has shown that on average, teachers speak between 120-165 words per minute. Effective teachers vary the speed at which they speak. To be effective, you need to slow and fast at the same time. How you speak in each case depends on the effect you want. The best advice however is to check with your listeners.

The fourth characteristic is pitch. This refers to a voice being high or low (deep) sound. Some people talk naturally in a high or low pitch. To be effective, one needs to vary the pitch to suit different purposes. A high pitched voice is usually not comfortable to the ears. People who use high pitched voices are perceived as being unauthoritative. Speakers are taken more seriously when they lower their pitch. As a teacher you need to strike a good balance between high and low pitch.

Vitality is also an important element of voice. We evaluate vitality or force by looking at the amount of energy, enthusiasm or liveliness used in delivery of a speech. If you love teaching a subject, this fact will be evident from the force that accompanies your communication. As a
teacher, you want to communicate to your students that you are interested in your work and the energy in your voice makes this obvious.

Your voice may carry all the above qualities but still be lacking in one key parameter, clarity. Clarity is not a characteristic of voice as such but deals more with use of language. Clarity or lack of it results from the way we pronounce especially English words.In multicultural or multi-lingual classroom contexts, teacher and student pronunciation may differ. In some ethnic languages, there are no letters such as "r" or " l " such that the teacher will say "fly lice" rather than "fry rice". Clarity can also be interfered with when we make wrong word choices or use words that are not familiar to learners.To enhance clarity, use simple words and when using technical words, ensure proper spellings and definitions are also used. In case of vernacular interference, you will improve if you put the right amount of effort. While you are working to improve, make humour your friend instead of being embarrassed each time you fail.

There are teachers who use unnecessary words or phrases. In so doing, you affect clarity. Instead of repeating frequently in your lesson, "do you understand?" or "are we together?",you can be more strategic in trying to find out if your learners have understood. You look more genuine when you ask a question instead of repeating phrases that are not useful. You couldplan classroom tasks beforehand that you will use to test their understanding.

Written communication is also a verbal type of communication. As a teacher you will use writing in different places and for different purposes. In the classroom, you will write on the black or white board. You will prepare teaching aids where you will use written words. You will prepare written handouts, task instructions, charts as well as give written feedback on students' writing. You will write performance reports, assignments, examinations and Power Point slides. Ensure you double check the words you choose, spelling, amount of detail necessary, the proper key concepts and also your handwriting and size of font where appropriate. When giving written feedback, make sure you provide positive comments that make students want to improve. If the work is poor in you view, do not just write "poor" but instead give a few hints or suggest an area or two the learner can work on. If it is good, do not just say "good", put a comment that qualifies what the learner has done well or why you like it. Avoid putting big marks or symbols which will not guide learner on how to improve.

You may want to reflect at this point: Does the type of comment or symbol you use have the power to affect the learner negatively? Can you avoid this negative effect or are you a victim of circumstances? Think about the function of communication (persuasion and influence) with regard to what teacher written comments can accomplish.

## Non-verbal communication

It is an integral part of verbal communication. This means that in most cases, it is used to augment verbal communication. We have already pointed out that non-verbal forms of
communication include facial expression, gestures, body posture, proximity to learners, time, grooming and dressing of the teacher. The face is by far the most important aspect of non-verbal communication. On you face are your eyes, eyebrows and your mouth. These combine with more than thirty muscles on your face to bring out different emotions. Communication is not just a transfer of messages or academic ideas for that matter. The teacher uses his face to communicate different emotions and attitudes in the classroom. A nod of the head to mean "yes", a smile to indicate "am pleased" a frown to say " behave yourself"are all used frequently in the classroom. Your smile is powerful non-verbal behavior. Eyes are useful in looking at students in order to attract your attention, to check their moods as well as to assure them you are listening. You use your face to showcare and empathy. Although words are appropriate, they need the support of a proper look and tone of voice. To be found trustworthy, the behavior must be consistent rather than on and off. The teacher should establish trust with students and how consistent you are non-verbally can tell if your words are genuine or not. Remember you can say that you care but your non-verbal signals prove the contrary. Actions, as they say, do not lie.

Gestures are used extensively by effective teachers to communicate a number of messages. The common gestures are those of the hands. Hand and also head gestures (combined with facial expression) will be used to focus attention on students, to emphasize a point, to encourage or discourage classroom behaviour and to communicate the mood of the teacher. An excited and happy teacher uses more hand and head gestures and a more straight posture. Body posture and body movement are important ways of communication. As much as possible teachers should be mobile and astraight open posture will be found more welcoming than a closed and drooping one. Mobility means moving to different parts of the classroom as you speak or as learners work in groupsHow much distance you maintain between you and your learners communicates a lot. There are times when it is necessary to move close to a student (proximity) when it is his turn to talk or merely to show that you have not ignored especially those at the back.

Time is another aspect of non-verbal teacher behaviour. How you use time in class communicates a great deal about your attitude towards your work and your attitude to the students. Learners can tell teachers who come to class unprepared because time is not well used and learner activity is low or absent. Coming to class in time communicates more positively than if you are late most of the time. How you allocate time on tasks is also important. How long you take to return student assignments also communicates your attitude to work and learners. Also, if something is really important, you will give students ample time to complete. Imagine getting learners to do group work where they take more time to settle into the group than to do the work! This can look exaggerated but it is true that some teachers do not plan group activities well. Students arrive at the answer with no effort. As a teacher you influence your learners by your dress and grooming. Dress and grooming are an extension of your personality and you want
to dress in a way that helps you command respect. Smart, clean and well ironed clothes add great value to your teacher-student relationship.

## Classroom delivery techniques

We have already seen that classroom communication plays two key roles. It helps the teacher teach subject content (instruction) or it is used to maintain classroom control (classroom management) so that learning can occur in a safe, warm and conducive atmosphere. In talking about classroom delivery techniques, one cannot therefore, separate these two functions. They are part and parcel of each other and one cannot operate without the other. The goal of teaching is to promote cognitive, affective, social-relating and affective skills (refer to chapter on aims and objectives of education). Lesson delivery is successful when opportunity is provided for this four-pronged type of teaching and learning. In talking of how you deliver a lesson, you have to think of how you get your verbal and non-verbal behaviour to support subject instruction as well as classroom control. We would argue that classroom management is the prerequisite for any effective instruction. Having said this, we can now look at some characteristics of good lesson delivery.

A good start in a lesson should try to prepare learners for the lesson in three ways:
A summary review of the previous lesson. This a brief summary and learners are involved as a way of checking their comprehension.

An overview of a new topic with regard to what the teacher hopes to achieve and how he/ she intends to go about it. Learner roles are clarified here but they can be emphasized as lesson progresses. Resources for use in lesson may be stated. Learners may be used by way of activating their background knowledge of a new topic. A question or relevant statement by the teacher may be used.

The third method has learner motivation in mind. Saying or doing something that motivates your learners is useful. Remember that how you start a lesson matters. Motivating sets include interesting or provocative questions, stories, activities or use of objects and pictures. Comments or activities from learners can stimulate an interesting start. It should be two-way so you need to involve your learners. Be careful to create a good balance in your choice of how you induct your learners to your lessons. Be careful not to overuse any approach.

Think of as many creative ways as possible of firing your learner's curiosity or interest in a new topic. Think of some as activities done by a select group of learners.

Create a theme and teach your subject around it. As part of teaching your subject you can negotiate a theme with learners around which to teach for a specified period of time. A given theme cam run for let us say three weeks or so. Themes to select from can be checked from the education goals articulated from the syllabus such as unity, integrity, love or virtues such as
truth and even skills such as active listening, confidence, imagination, reflection and so forth. Making reference to the select theme can be a good way to change mood of your class. You could say: Let us see how our theme on....applies to our topic so far.

Your voice effectively and keep in mind what we have already discussed about voice quality.
Let learners know at the beginning what you intend to accomplish by way of stating or writing down specific objectives of the lesson topic. Clarify what you expect them to learn and do and if any resources will be required, you can ask them to make sure they are ready.

Your conversation with learners is a discourse and to help them follow you clearly, various discourse markers (also known as transition signals). You have covered these in your first year unit (Communication Skills).These help them identify key points easily and makes listening and note-taking less difficult. You may attempt at this juncture to remind yourself what these are by coming up with examples under the following categories of markers: Markers of beginning a lesson or introduction, those that indicate definition, cause and effect relationships, addition, comparison-contrast, examples, and those for concluding.

Pause is a very important aspect of effective classroom delivery. You can pause to demarcate two different parts of a lesson, or just before you move to the next point. When you ask a question, pause to give learners time to think of the answer. Pausing at strategic points is a mark of confidence and not a lack of it. Pause to recollect your thoughts when required about how you want to proceed with the lesson. Planning is a mental process and you can pause to weigh which is a proper way to proceed.

Display your passion for the topic as well as your attitude towards the learners using both words, gestures and body movement. Imagine yourself standing still with hands in one position. What will your learners think? Relate subject to the real word, make brief interesting digressions, use your personal experiences as well as humour. Even so, be careful not to portray the picture that you have learned everything on the topic. Try and give impression that learning is an ongoing process. What if you do not know the answer? Take time and research what positive comments are suitable for such a situation.

How time is used during a lesson matters to the learner. Make sure time is used well by applying a learner-centered approach. This means that rather than dominate lesson with teacher talk, ensure learners are active; individually or in groups. Plan ahead for active learning that is meaningful and also challenging and engaging.

Notice that effective delivery also involves other aspects such as use of learning resources and this has been treated in chapter three on instructional resources. You may also at this point think about use of repetition and also teacher modelling as aspects of effective delivery. Find out how you model communication and learning behaviour so that you are leading by example.

Remember your learners will copy all positive behaviour but, are also capable of mocking or making fun of negative communication.

## Definition of Key Words and Concepts

Classroomcommunication: is verbal and non-verbal and is used by both teacher and learners to ensure that a conducive environment is created which supports learning and understanding of the subject matter. Teachers and learners use it to communicate ideas, feelings, attitudes and values.

Feedback: refers to verbal and non-verbal responses by both teacher and learner. Feedback can be spoken or written and can be given during a lesson or outside the classroom. Feedback targets students cognitive development as well as their behaviour and even interests.

Influence : is an effect of ones communication on another. In the classroom the teacher can influence learners by he/she communicates or vice-versa. This is done more indirectly. If you want to win trust from learners, you will not say directly, "trust me"!

Persuasion: is using certain words or non-verbal behaviour in the classroom with the deliberate intention of wanting to change student thinking or their behaviour. This is done directly or indirectly. You can promise some award for instance.

Metacognition: (Developed by John Flavel in1979), the term refers to how we think about our thinking and it can be applied with learners so that they cultivate a habit of checking if they are thinking appropriately regarding a given issue or checking their feelings and reactions towards a given situation. The goal is to come up with the best possible thought or decision. Metacognitive strategies are learning strategies.

Non-verbal communication: refers to channels of communication that do not use spoken or written words to transmit messages

Verbal communication: refers to spoken and written words.

## ACTIVITIES

Communication is largely concerned with persuasion and influence. Make a list of ten things you would both say and do that could have a positive influence on your learners.

Contrast traditional and contemporary views of communication.
How would you use communication to arrive at an understanding of yourself, your learners and the subject you are teaching?

Using a topic in your subject, give examples of closed and open-ended questions. Construct some quality questions that can promote deep learning and creative thinking on some issues.

Teacher feedback is all about supporting students learning. Discuss.
Discuss qualities of an effective teacher in regard to their communication.
Identify and explain five communication techniques for effective lesson delivery
Effective communication is learner-centered. Illustrate the truth of this statement using examples from the four functions of communication.

## UNIT - 5

## MATHEMATICAL REASONING AND APTITUDE

- Types of Reasoning.
- Number series, letter series, codes and relationships.
- Mathematical aptitude
- Faction.
- Time and Distance.
- Ratio proportion and percentage.
- Profit and loss.
- Interest and Discounting.
- Averages etc.

Types of Reasoning:There are mainly three types of reasoning such as,Inductive Reasoning, Deductive Reasoning,Abductive Reasoning

Inductive reasoning is based on observations and not any hypothesis. If any phenomena are observed for n number of times, it can be generalized. This generalization is based on observation and therefore it may be false. Inductive reasoning is a logical guess which can be backed up by using valid reasons. This type of reasoning is not used in geometry, for instance, one may observe a few right triangles and conclude all triangles to be right triangles. Therefore, other mathematical tools are used to prove geometrical results. An example of inductive reasoning will help elucidate the concept.

Example of Inductive Reasoning:
$>$ Statement: I picked a ball from the bag and it happens to be a red ball. I picked a second red ball. A third ball from the bag is also red. Therefore, all the balls in the bag are red.
$>$ Reasoning: All the balls picked up from the bag are red. Therefore, we can say all the balls are red. This is an example of inductive reasoning where existing data is analyzed to come to a general conclusion.

Deductive reasoning is based on the exact opposite principles of induction. Unlike Inductive reasoning, Deductive reasoning is not based on simple generalizations. A Hypothesis is required or a statement that has to be true under specified conditions for deductive reasoning to be valid. In the case of Inductive reasoning, the conclusion may be false but Deductive reasoning is true in all cases. Therefore, Deductive reading is used for geometrical and mathematical proofs. The following example will simplify the concepts discussed in this section.

## Example of Deductive Reasoning:

$>$ Statement: The sum of angles in a triangle is always equal to $180^{\circ}$ and ABC is a Triangle.
$>$ Reasoning: Here in the given statement we are considering two hypotheses, where the sum of angles in a triangle is said to be $180^{\circ}$ and ABC is a triangle. Based on the given hypotheses we deduce that the sum of angles of ABC is $180^{\circ}$.

Abductive reasoning is a modified version of Inductive Reasoning and takes a more practical approach. In the case of inductive reasoning, the data or observation is complete but in real situations, most of the data is not available at the time of making a decision. So based on the data and its availability, the conclusion may vary and reasoning may change.

## Example of Abductive Reasoning:

$>$ Statement: The heights of four students studying in a class were found to be 160 cm , $162 \mathrm{~cm}, 163 \mathrm{~cm}, 167 \mathrm{~cm}$ respectively. The measuring scale available had the least count of 1 cm .
> Reasoning: As per the data and hypotheses available at the time of observation, the average height comes out to be 163 cm . But once a new measuring scale was installed the least count was found to be 0.1 cm and the recorded height of students changed. This also impacted the Average height which came to be 63.8 cm .

## What are the types of reasoning statements?

Reasoning statements in mathematics are broadly classified into three types:
> Simple Statements
$>$ Compound Statements
> If-Then Statements
Simple Statements:If the truth value of a statement or proposition does not directly depend on another statement, it is a simple statement. In other words, a simple statement should not be composed of simpler statements.
$>$ Therefore a simple statement can never be broken down into simpler statements. It is easiest to work with simple statements and direct reasoning approach can be implemented. A few examples have been provided to clear the concept of simple statements.

## Example 1: Square is a parallelogram.

$>$ Reasoning: There are no modifiers in the given statement. Therefore we can say that the given statement is simple.
$>$ Compound Statement:In simple words, the combination of simple statements is a compound statement. Therefore, such statements are made of either two or more simple statements joined together by connectives like 'and', 'or'.
$>$ A variety of connectives can be used instead of the two connectives as mentioned. These statements are crucial for Deduction reasoning in Mathematics. Have a look at the detailed example below for a better understanding:
> Example 1: We have taken two simple statements that can be joined together by the use of a connector.
> Statement 1: Parallel lines do not intersect.
> Statement 2: Transversal lines make equal alternate angles with parallel lines
> Compound Statement: Parallel lines do not intersect and Transversal lines make equal alternate angles with parallel lines.
$>$ Example 2: In this example, a compound statement is being dissected into its simple statement components.
$>$ Compound Statement: Triangle has three sides and the square has four sides.
The Simple Statements for this statement is:
$>$ Statement 1: Triangle has three sides.
$>$ Statement 2: The square has four sides.
If-then Statement:Conditional statements where a hypothesis is followed by a conclusion are known as the If-then statement. If the hypothesis is true and the conclusion is false then the conditional statement is false. Likewise, if the hypothesis is false the whole statement is false.

Example 1: If $40 \%$ population is female then $60 \%$ population is male.
$>$ Reasoning: Here the $40 \%$ female is the hypothesis and if that condition is met then the conclusion is satisfying.

## Number Series

$>$ The Natural Numbers
$>$ The natural (or counting) numbers are $1,2,3,4,5,1,2,3,4,5$, etc. There are infinitely many natural numbers. The set of natural numbers, $\{1,2,3,4,5\}$ is sometimes written NN for short.
$>$ The whole numbers are the natural numbers together with $0 .(0,1,2,3,4,5, \ldots, \ldots)$

Even Numbers: 2,4,6,8,10...... 100
$>$ Add numbers: 1,3,5,7,9. .99
$>$ The sum of any two natural numbers is also a natural number (for example, $4+2000=2004$ ), and the product of any two natural numbers is a natural number $(4 \times 2000=80004)$. This is not true for subtraction and division, though.
$>$ The Integers
$>$ The integers are the set of real numbers consisting of the natural numbers, their additive inverses and zero.
$>\{\ldots,-5,-4,-3,-2,-1,0,1,2,3,4,5$
$>$ The set of integers is sometimes written J or Z for short.
$>$ The sum, product, and difference of any two integers is also an integer. But this is not true for division...

## Square and Square Root Table

| Square | Square Root | Square | Square Root |
| :--- | :--- | :--- | :--- |
| $1^{2}=1$ | $\sqrt{1}=1$ | $16^{2}=256$ | $\sqrt{256}=16$ |
| $2^{2}=4$ | $\sqrt{4}=2$ | $17^{2}=289$ | $\sqrt{289}=17$ |
| $3^{2}=9$ | $\sqrt{9}=3$ | $18^{2}=324$ | $\sqrt{324}=18$ |
| $4^{2}=16$ | $\sqrt{16}=4$ | $19^{2}=361$ | $\sqrt{361}=19$ |
| $5^{2}=25$ | $\sqrt{25}=5$ | $20^{2}=400$ | $\sqrt{400}=20$ |
| $6^{2}=36$ | $\sqrt{36}=6$ | $21^{2}=441$ | $\sqrt{441}=21$ |
| $7^{2}=49$ | $\sqrt{49}=7$ | $22^{2}=484$ | $\sqrt{484}=22$ |
| $8^{2}=64$ | $\sqrt{64}=8$ | $23^{2}=529$ | $\sqrt{529}=23$ |
| $9^{2}=81$ | $\sqrt{81}=9$ | $24^{2}=576$ | $\sqrt{576}=24$ |
| $10^{2}=100$ | $\sqrt{100}=10$ | $25^{2}=625$ | $\sqrt{625}=25$ |
| $11^{2}=121$ | $\sqrt{121}=11$ | $26^{2}=676$ | $\sqrt{676}=26$ |
| $12^{2}=144$ | $\sqrt{144}=12$ | $27^{2}=729$ | $\sqrt{729}=27$ |
| $13^{2}=169$ | $\sqrt{169}=13$ | $28^{2}=784$ | $\sqrt{784}=28$ |


| $14^{2}=196$ | $\sqrt{196}=14$ | $29^{2}=841$ | $\sqrt{841}=29$ |
| :--- | :--- | :--- | :--- |
| $15^{2}=225$ | $\sqrt{225}=15$ | $30^{2}=900$ | $\sqrt{900}=30$ |

Cube of 1 to 20

| $1^{3}=1$ | $11^{3}=1331$ |
| :--- | :--- |
| $2^{3}=8$ | $12^{3}=1728$ |
| $3^{3}=27$ | $13^{3}=2197$ |
| $4^{3}=64$ | $14^{3}=2744$ |
| $5^{3}=125$ | $15^{3}=3375$ |
| $6^{3}=216$ | $16^{3}=4096$ |
| $7^{3}=343$ | $17^{3}=4913$ |
| $8^{3}=512$ | $18^{3}=5832$ |
| $9^{3}=729$ | $19^{3}=6859$ |
| $10^{3}=1000$ | $20^{3}=8000$ |

## Types of Series

Even Number: 2,4,6,8,10,
Add Number: 1,3,5,7,9..
Square Root: 1,4,9,16........(25) (1 $\left.1^{1} 2^{2} 3^{2} 4^{2} 5^{2}\right)$
Cube Root: $1,8,27,64 \ldots . . . . .(125)\left(1^{3}, 2^{3}, 3^{3}, 4^{3} 5^{3}\right)$
Prime No: 2,3,5,7,11, (13)

## Examples

1) $5,25,7$, $\qquad$ ,9, 19
A) 23
B) 22
C) 25
D) 32
E) None of The Above

## Solution (Option B)


$>62,64$, $\qquad$ , 32, 14,16
A) 26
B) 28
C) 30
D) 32
E) None of The Above

Solution (Option) C
62
64
30
32
14
16

$>100,50,52,26,28$,
A) 30
B) 32
C) 14
D) 16
E) None of The Above
$>$ Solution (Option C)

$>980,392,156.8$, $\qquad$ , 25.088, 10.0352
a) 62.72
b) 63.85
c) 65.04
d) 60.28
e) None of The Above
$>$ Solution (Option A)

$113,225,449$ $\qquad$ , 1793
a) 789
b) 786
c) 897
d) 987
e) None of The Above
$>$ Solution (Option C)
113
225
449


897
1793


$>$ 10) $2, \quad 9$, $\qquad$ , 105, 436, 2195
A) 25
B) 27
C) 30
D) 33
E) None of The Above
$>$ Solution (Option C)

$>33,321,465,537,573$ $\qquad$
a) 600
b) 591
c) 585
d) 498
e) None of The Above
$>$ Solution (Option B)

$>45,46,70,141$, $\qquad$ , 1061.5
a) 353
b) 353.5
c) 352.5
d) 352
e) None of The Above
$>$ Solution (Option B)

$2,10,30,68$, $\qquad$
a) 126
b) 130
c) 140
d) 150
e) None of The Above

Solution (Option B)

$>5,9,21,37,81$, $\qquad$
a) 163
b) 153
c) 181
d) 203
e) None of The Above
$>$ Solution (Option B)


## Speed Time \& Distance

Formula:
$>$ Distance $=$ Speed $\times$ Time
> Time $=$ Distance/Speed
> Speed $=$ Distance $/$ Time
> Convert $\mathrm{Km} / \mathrm{h}$ to $\mathrm{M} / \mathrm{s}=\mathrm{Km} / \mathrm{h} * 5 / 18=\mathrm{m} / \mathrm{s}$ or $\mathrm{m} / \mathrm{sec} * 18 / 5=\mathrm{km} / \mathrm{h}$
$>$ Calculate Average Speed $=2 x y / x+y$
Q1. A person travels from one place to another at $30 \mathrm{~km} / \mathrm{hr}$ and returns at $120 \mathrm{~km} / \mathrm{hr}$. If the total time taken is 5 hours, then find the Distance.

Distance $=$ Speed $\times$ Time
Ratio of speed is $=30: 120=1: 4$
So the ratio of time is $=4: 1$
Total Time $=5$ Hours. Time taken going 4 hour, 1 hour for returned time.
Distance $=$ Speed $\times$ time

$$
=30 \times 4=120 \mathrm{~km}
$$

## Solutions:

Here the Distance is constant, so the Time taken will be inversely proportional to the Speed. Ratio of Speed is given as $30: 120$, i.e. 1:4

So the ratio of Time taken will be $4: 1$.
Total Time taken $=5$ hours; Time taken while going is 4 hours and returning is 1 hour.
Hence, Distance $=30 \times 4=120 \mathrm{~km}$
2. Shweta when increases her speed from $24 \mathrm{~km} / \mathrm{hr}$ to $30 \mathrm{~km} / \mathrm{hr}$ she takes one hour less than the usual time to cover a certain distance. What is the distance usually covered by Shweta?

Speed of the Ratio $=24: 304: 5$
Time Ratio =5:4 Time Difference $=5-4=1$ hour
$D=S \times T \quad D=24 \times 5=120 \mathrm{~km}$
Sol.
Speed's Ratio $\rightarrow 24$ : 30
4 : 5

Time's Ratio $\left(\alpha \frac{1}{\text { speed }}\right) 5: 4$
Difference in time $\rightarrow(5-4) r \rightarrow 1$ hour

$$
\begin{aligned}
& 1 r \rightarrow 1 \text { hour } \\
& 5 r \rightarrow 5 \text { hour }
\end{aligned}
$$

Distance $=24 \times 5=120 \mathrm{~km}$
3. Udai travels half of his journey by train at the speed of $120 \mathrm{~km} / \mathrm{hr}$ and rest half by car at 80 $\mathrm{km} / \mathrm{hr}$. What is the average speed?
Average Speed $=2 x y / x+y$
$X=120$
$Y=80$
$A=\frac{2 \times 120 \times 180}{120+80}=\frac{2 \times 120 \times 8}{200}=\frac{12 \times 8}{2}$
Step 2
Sol. Average speed $\rightarrow \frac{2 x y}{x+y}$
$x \rightarrow 120$
$y \rightarrow 80$
Average speed $=\frac{2 \times 120 \times 80}{200}=96 \mathrm{~km} / \mathrm{hr}$
4. The distance between two cities $A$ and $B$ is 330 km . A train starts from $A$ at 8 a.m. and travels towards B at $60 \mathrm{~km} / \mathrm{hr}$. Another train starts from B at $9 \mathrm{a} . \mathrm{m}$. and travels towards A at $\mathbf{7 5} \mathbf{~ k m} / \mathrm{hr}$. At what time do they meet?
Time $=$ Distance $/$ Speed
A train 8 a.m $60 \mathrm{~km} / \mathrm{hr} 1$ hour A train reached 60 km
B train 9 a.m $75 \mathrm{~km} / \mathrm{hr}$
Total distance $=330-60=270$
$\mathrm{T}=\mathrm{D} / \mathrm{S} \quad 270 / 60+75=270 / 135=2$ hour
B train $9 \mathrm{am}=9+2=11 \mathrm{a} . \mathrm{m}$

Step 2
Sol. Distance covered by train started from A in 1 hour $=60 \mathrm{~km} / \mathrm{hr}$
Remaining Distance $=330-60=270$
Time $=\frac{270}{135}=2$ hours
They will meet at $=9+2=11: 00 \mathrm{am}$
5. A person goes from $A$ to $B$ at the speed of 40 kmph and comes back at the speed of $\mathbf{6 0} \mathbf{~ k m p h}$. What is his average speed for the whole journey?

Average Speed $=2 x y / x+y$
$X=40 \quad Y=60$
A.S. $=\frac{2 \times 40 \times 60}{40+60} \frac{2 \times 40 \times 60}{100} 2 \times 4 \times 6=48 \mathrm{~km} / \mathrm{hr}$

Solution: Since the distance traveled on both sides is the same, we can use the formula of harmonic mean of speeds. Average Speed: $2 x y /(x+y)$ where, $x$ is the speed while going from A to $B$ and $y$ is the speed while coming back. So using this formula, we get the answer as 48 kmph .
6. Moving at 50 kmph , a person reaches his office 10 min late. Next day, he increases his speed and moves at 60 kmph and reaches his office 5 min early. What is the distance from his home to his office?
$D=S \times T$
Speed ratio $=50: 60=5: 6$
Time ratio $=6: 5$
$D=S \times T=50 \times 6=300$
$10+5=15 \mathrm{~min} 15 / 60$

$$
=300 \times 15 / 60=75 \mathrm{~km}
$$

7. If a car runs at $45 \mathrm{~km} / \mathrm{hr}$, it reaches its destination late by $\mathbf{1 0} \mathbf{~ m i n}$ but if runs at $60 \mathrm{~km} / \mathrm{hr}$ it is late by 4 min . What is the correct time for the journey?
A. 24 min
B. 14 min
C. 32 min
D. 20 min
E. 46 min

Time Difference $=10-4=6 \mathrm{~min}$
D $=\mathrm{S} \times \mathrm{T}$

$$
\begin{aligned}
& =\frac{45 \times 60}{45-60}=\frac{6}{60}=\frac{45 \times 60}{15}=\frac{6}{60}=3 \times 6=18 \mathrm{~km} \\
T & =D / S \\
T & =18 / 45=2 / 5 \\
& =2 / 5 \times 60=24 \\
& =24-10=14 \mathrm{~min}
\end{aligned}
$$

Step 2
$45(T+10)=60(T+4)=45 T+40=60 T+240$
$45 T-60 T=240-45$
$15 T=200 T=200 / 15=14 \mathrm{Min}$
8. A man covers a distance of 600 m in 2 min 30 sec . What will be the speed in $\mathrm{km} / \mathrm{hr}$ ?

Time Convert $=2 \min 30 \mathrm{sec}=120+30=150$
Distance $=600 \mathrm{~m}$
$S=D / t=600 / 150=4 \mathrm{~m} / \mathrm{s}$
$4 \times 18 / 5=14.4 \mathrm{kmhr}$.

## Solution:

Speed $=$ Distance $/$ Time
$\Rightarrow$ Distance covered $=600 \mathrm{~m}$, Time taken $=2 \mathrm{~min} 30 \mathrm{sec}=150 \mathrm{sec}$
Therefore, Speed $=600 / 150=4 \mathrm{~m} / \mathrm{sec}$
$\Rightarrow 4 \mathrm{~m} / \mathrm{sec}=\left(4^{*} 18 / 5\right) \mathrm{km} / \mathrm{hr}=14.4 \mathrm{~km} / \mathrm{hr}$.
9. A boy goes to school at a speed of 3 kmph and returns to the village at a speed of 2 kmph . If he takes 5 hrs in all, what is the distance between the village and the school?
$\mathrm{D}=x \mathrm{~km}$
$1^{\text {st }}$ Journey $=x / 3 \mathrm{kmpr}$
$2^{\text {nd }}$ Journey $=x / 2 \mathrm{kmhr}$
$x / 3+x / 2 / 3 x 2=5 \mathrm{hr}$
$2 x+3 x / 6=5$
$=5 x=30$
$X=5 / 30=6 \mathrm{~km}$

## Time \& Work

## Formulas

If $M 1$ men can do $W 1$ work in $D 1$ days working $H 1$ hours per day and $M 2$ men can do $W 2$ work in $D 2$ days working $H 2$ hours per day, then
$\frac{\mathrm{M} 1 \times \mathrm{D} 1 \times \mathrm{H} 1}{\mathrm{~W} 1}=\frac{\mathrm{M} 2 \times \mathrm{D} 2 \times \mathrm{H} 2}{\mathrm{~W} 2}$
$A$ and $B$ can do a piece of work in ' $a$ ' days and ' $b$ ' days respectively, then working together:

1. They will complete the work in $A B$ days

$$
\frac{A+B}{A B}
$$

In one day, they will finish $A+B$ part of work.
If $A$ can do a piece of work in a days, $B$ can do in bb days and $C$ can do in $c c$ days then,
$A, B$ and $C$ together can finish the same work in $\frac{A B C}{A B+B C+C A}$ Days
If $A$ can do a work in $x$ days and $A$ and $B$ together can do the same work in $y$ days then,
Number of days required to complete the work if $B$ works alone $\frac{X Y}{X-Y}$ Days
If $A$ and $B$ together can do a piece of work in $x$ days, $B$ and $C$ together can do it in $y$ days and C and A together can do it in z days, then number of days required to do the same work:

If $\mathrm{A}, \mathrm{B}$, and C working together $=\frac{2 \mathrm{XYZ}}{\mathrm{XY}+\mathrm{YZ}+\mathrm{ZX}}$
If A working alone $=\frac{2 \mathrm{XYZ}}{\mathrm{XY}+\mathrm{YZ}-\mathrm{ZX}}$
If B working alone $=\frac{2 \mathrm{XYZ}}{-\mathrm{XY}+\mathrm{YZ}+\mathrm{ZX}}$
If C working alone $=\frac{2 \mathrm{XYZ}}{\mathrm{XY}-\mathrm{YZ}+\mathrm{ZX}}$

## Examples

A and B together can complete a particular task in 4 days. If A alone can complete the same task in 12 days. How many days will B take to complete the task if he works alone?
A) 9 days
B) 7 days
C) 5 days
D) 3 days
E) 6days
$\mathrm{A}+\mathrm{b}$ together work $=4$ days
A alone work $=12$ days
$\frac{A B}{A-B}=\frac{4 \times 12}{12-4}=\frac{48}{8}=6$ days
P is thrice as good a workman as Q and together they finish a piece of work in 24 days. The number of days taken by P alone to finish the work is:
A) 25 days
B) 22 days
C) 32 days
D) 34 days

Ps day: Q s days $=3: 1=4$
$P+$ Q 1 day work $=1 / 24$
P alon work $=\frac{1+3}{24}=\frac{1}{4}=\frac{1 / 32}{8 \times 4}=\mathrm{P}$ alone work 32 days
6 women can complete a piece of work in 10 days, whereas 10 children alone take 15 days to complete the same piece of work. How many days will 6 women and 10 children together take to complete the piece of work?
A) 7
B) 8
C) 6
D) 4

6 womens 1 day work $=1 / 10$
10 children 1 days work $=1 / 15$
$6 \mathrm{w}+10 \mathrm{c}=$
$=1 / 10+1 / 15=5 / 30=1 / 66 \mathrm{w}+10 \mathrm{c}$ together 6 days
A and B together can finish a work in 9 days. A alone can finish the work in 12 days. In how many days will B alone finish the work?
A) 24
B) 28
C) 32
D) 36

A $+\mathrm{B}=9$ days
$\mathrm{A}=12$
$\mathrm{AB} / \mathrm{A}-\mathrm{B}=9 \times 12 / 12-9=108 / 3=36$ days
18 women can complete a work in 12 days and 12 men can complete the same work in 9 days. In how many days will 8 men and 8 women complete that work?
A) 9
B) 6
C) 12
D) 8

1 women 1 day work
$1 / 12 \times 18=1 / 216$
1 man 1 day work
$1 / 12 \times 9=1 / 108$
$8 \mathrm{w}+8 \mathrm{~m} 1$ day work $=$ ?
$=8 / 108+8 / 216=2 / 27+1 / 27=3 / 27=1 / 9$
$8 \mathrm{~m}+8 \mathrm{w}$ complete work 9 days

## Divisible Rules

Divisible by 2 - If a number ends with $0,2,4,6,8$ then the number is divisible by 2 .
Example $-254,326,3548,4210$. All number ends with $4,6,8,0$ so these numbers are divisible by 2.

Divisible by 3 - If sum of all the digits of a number is divisible by 3 , then the number itself, is also divisible by 3 .
Example $-375,4251,78123$. Here we are taking another example of $549-5+4+9=18$ which is divisible by 3 , so 549 is also divisible by 3 .

Divisible by 4 - If the last two digits of any number is divisible by 4 , then the number is also divisible by 4.

Example -2348 .Here last two digits 48 are divisible by 4 , so 2348 is also divisible by 4 .
Divisible by 5 - If a number ends with 0 or 5 , then it is divisible by 5 .
Example-340, 625.
Divisible by 6 - If a number is divisible by both 2 and 3, then it is divisible by 6 as well.
Example -4536 . Here the number ends on 6 which is divisible by 2 and the sum of digits $(4+5+3+6=18)$ which is divisible by 3 also, so the number 4536 is divisible by 6 .

Divisible by 8 - If the last three digits of a number can be divided by 8 , then the number is divisible by 8 .

Example -746848 . Here last 3 digits 848 are divided by 8 , hence the number 746848 is divisible by 8 .

Divisible by 9- if the sum is a multiple of 9 or if the sum of its digits is divisible by 9
Examples- $99,9+9=18,198=1+9+8=18,3411=3+4+1+1=9,9990=9+9+9+0=27$.
Divisible by 10 - If a number ends with 0 , then it is divisible by 10 .
Example-120, 330, 500.

Divisible by $\mathbf{1 1}$ - If (sum of its digit in odd places) is subtracted by (sum of its digits in even places) $=0$ or multiple of 11 , then the number is divisible by 11 .
Example -39798846 Sum of digits at odd places $=3+7+8+4=22$ Sum of digits at even places $=9+9+9+6=33$ Now $->33-22=11$ which is multiple of 11 so number is divisible.
Divisible by 12- If a number is divisible by 3 and 4 both, then it will also be divisible by 12 as well.

Example - 4848 is divisible by 3 and 4 both, so it will be divisible by 12 also.
Divisible by 14 - If a number is divisible by 2 and 7 both, then it will also be divisible by 14 as well.

Divisible BY 7 It doubles the last digit of the number and aslo to subtract it from the remaining numbers.

Examples-133, 3 is $6,13-6=7,329,9$ is $18,32-18=14$,
Example - 4242 is divisible by 2 and 7 both, so it will be divisible by 14 also. Last digit 2 is 4 , 424-4=420,
Divisible by $\mathbf{1 5}$ - If a number is divisible by 3 and 5 both, then it will also be divisible by 15 as well.
Example -4545 is divisible by 3 and 5 both, so it will be divisible by 15 also.
Divisible by 16 - A number is divisible by 16 , if the number formed by the last digits is divisible by 16 .
Example - 7957536 Last four digits 7536 are divisible by 16.
Divisible by 24 - If a number is divisible by 3 and 8 both, then it will also be divisible by 14 as well.
Example -4848 is divisible by 3 and 8 both, so it will be divisible by 24 also.
Divisible by 40 - If a number is divisible by 5 and 8 both, then it will also be divisible by 40 as well.

Example -8080 is divisible by 5 and 8 both, so it will be divisible by 40 also.
Divisible by 80 - If a number is divisible by 5 and 16 both, then it will also be divisible by 80 as well.

Example - 80160 is divisible by 5 and 16 both, so it will be divisible by 80 also.

## Age related Questions

1. The age of a man is 4 times of his son. Five years ago, the man was nine times old as his son was at that time. The present age of man is?

Son age $X$ and father is $4 x$ years
$=4 \mathrm{x}-5=9(\mathrm{x}-5)$
$=4 \mathrm{x}-5=9 \mathrm{x}-45$
$=4 \mathrm{x}-9 \mathrm{x}=45-5$
$=5 \mathrm{x}=40$
$=x=40 / 5=8$
$=$ present age of man $=4 x=4 \times 8=32$ year
2. The ratio of the present ages of P and Q is $3: 4$. Five years ago, the ratio of their ages was $5: 7$. Find their present ages.
$P \& Q$ present age $=3: 4$, means present age $3 x$ and $4 x$
5 Year ago their age 5:7, means $3 x-5: 4 x-5$
$=5: 7$
$=5(4 \mathrm{x}-5)=7(3 \mathrm{x}-5)$
$=20 \mathrm{x}-25=21 \mathrm{x}-35$
$=20 \mathrm{x}-21 \mathrm{x}=25-35$
$=\mathrm{x}=10$
Present age $\mathrm{P} \& \mathrm{Q}=3: 4$ means $3 \mathrm{x}=3 \times 10=30,4 \mathrm{x}=4 \times 10=40$.
3. The sum of the present ages of a father and his son is 60 years. five years ago, father's age was four times the age of the son. so now the son's age will be:
Present age of son and father is X and $60-\mathrm{x}$
Then $(60-x)-5=4(x-5)$
$=55-\mathrm{x}=4 \mathrm{x}-20$
$=x+4 x=55+20$
$=5 \mathrm{x}=75$
$\mathrm{X}=75 / 5=15$
Present age of son $=15$,
4. The average age of a group of 10 students is 15 years. When 5 more students join the group, the average age increase by 1 year. The average age of the new students is?
Average age of 10 students is 15 years $=10 \times 15=150$
15 students and 16 years $=15 \times 16=240$

New 5 students average age $=240-150=90$
$=90 / 5=18$ years
5. Rajeev's age after 15 years will be 5 times his age 5 years back. What is the present age of rajeev?

Rajeev present age X years
Rajeev age after 15 years $=X+15$
Rajeeva age 5 years ago $=X-5$
$X+15=5(x-5)$
$=\mathrm{X}+15=5 \mathrm{x}-25$
$X-5 x=15+25$
$4 \mathrm{x}=40$
$=x=40 / 4=10$
Rajeev present age is 10
6. Mother's age today is thrice as her daughter's. After 10 years it would be just double. How old is the daughter today?

Todays daughter age X years
Mother's age today $=3 x$ years
After 10 years $=3 x+10=2(x+10)$
$=3 \mathrm{x}+10=2 \mathrm{x}+20$
$=3 \mathrm{x}-2 \mathrm{x}=10-20$
$=\mathrm{x}=10$
Today's age of daughter $=10$

## Profit \& Loss

## Basic Definitions

- The price at which articles/ item purchased is called as Cost Price (C.P.).
- The price at which articles/ item sold is called as Selling Price (S.P.).

IMPORTANT FORMULAE

1. Gain $=($ S.P. $)-($ C.P. $)$
2. Loss $=($ C.P. $)-($ S.P. $)$
3. Loss or gain is always reckoned on C.P.
4. Gain Percentage: (Gain \%)

Gain $\%=\left(\frac{\text { Gain } \times 100}{\text { C.P. }}\right)$
5. Loss Percentage: (Loss \%)

Loss $\%=\left(\frac{\operatorname{Loss} \times 100}{\text { C.P. }}\right)$
6. Selling Price: (S.P.)
$\mathbf{S P}=\left[\frac{(100+\text { Gain \%) }}{100}\right]$
7. Selling Price: (S.P.)
$\mathrm{SP}=\left[\frac{(100-\operatorname{Loss} \%)}{100} \times\right.$ C.P. $]$
8. Cost Price: (C.P.)
C.P. $=\left[\frac{100}{(100+\text { Gain } \%)} \times\right.$ S.P. $]$
9. Cost Price: (C.P.)
$\left[\frac{100}{(100-\operatorname{Loss} \%)} \times\right.$ S.P. $]$
10. If an article is sold at a gain of say $35 \%$, then S.P. $=135 \%$ of C.P.
11. If an article is sold at a loss of say, $\mathbf{3 5 \%}$ then S.P. $=\mathbf{6 5 \%}$ of C.P.
12. When a person sells two similar items, one at a gain of say $x \%$, and the other at a loss of $\mathbf{x} \%$, then the seller always incurs a loss given by:
$\operatorname{Loss} \%=\left(\frac{\text { Common Loss and Gain\% }}{10}\right)^{2}=\frac{x^{2}}{100}$
13. If a trader professes to sell his goods at cost price, but uses false weights, then Gain \% $=[$ Error $\times 100] \%$

## Formula Explanations

## Profit or Gain

If Selling Price (S.P.) is more than the Cost Price (C.P.) of article/ item then the difference between selling price and cost price is known as Profit.

Profit $=$ Selling Price (S.P.) - Cost Price (C.P)
Formula for \% Gain is as follows
$\%$ Gain $=$ GainC.P. $\times 100=$ GainC.P. $\times 100$
Formula can be also represented as follows
\% Gain =(S.P. - C.P.) C.P. $\times 100=($ S.P. - C.P.) C.P. $\times 100$
Formula for calculating Selling Price (S.P.) when \% Gain/Profit and Cost Price (C.P.) is given for article.
S.P. $=(100+\%$ Profit $) 100 \times$ C.P.S.P. $=(100+\%$ Profit $) 100 \times$ C.P.

Formula for calculating Cost Price (C.P.) when \% Gain/Profit and Selling Price (S.P.) is given for article.
C.P. $=100(100+\%$ Profit $) \times$ S.P.

## 3. Loss

If Selling Price (S.P.) is less than the Cost Price (C.P.) of article/ item then the difference between selling price and cost price is known as Loss.

Loss $=$ Cost Price (C.P) - Selling Price (S.P.)
Formula for \% Gain is as follows
$\%$ Loss $=$ Loss C.P. $\times 100=$ LossC.P. $\times 100$
Formula can be also represented as follows

$$
\% \text { Loss }=(\text { C.P. - S.P.) C.P. } \times 100=(\text { C.P. - S.P.) C.P. } \times 100
$$

Formula for calculating Selling Price (S.P.) when $\%$ Loss and Cost Price (C.P.) is given for article.

$$
\text { S.P. }=(100-\% \text { Loss }) 100 \times \text { C.P.S.P. }=(100-\% \text { Loss }) 100 \times \text { C.P. }
$$

Formula for calculating Cost Price (C.P.) when \% Loss and Selling Price (S.P.) is given for article.

$$
\text { C.P. }=100(100-\% \text { Loss }) \times \text { S.P. }
$$

## Examples:

Question 1 Lentil is purchased for Rs. 115 and sold for Rs. 135. Find the profit percent.
Profit $=$ SP - CP, $135-115=20$ Profit $\%=$ Profit $\% / C P \times 100$
Profit\% $=20 / 115 \times 100=17.39 \%$
2. A man buys an article for Rs. 27.50 and sells it for Rs 28.60 . Find his gain percent
A. $1 \%$
B. $2 \%$
C 3\%
D 4\%
C. $\mathrm{P}=27.50 \mathrm{SP}=28.60=\mathrm{SP}-\mathrm{CP}=28.60-27.50=1.10$

Profit $\%=$ Profit $\% / \mathrm{CP} \times 100$
$\%=1.10 / 27.50 \times 100 \quad 1.10 \times 100=1.1027 .50=4 \%$
3. A TV is purchased at Rs. 5000 and sold at Rs. 4000 , find the lost percent.
A. $10 \%$
B. $20 \%$
C. $25 \%$
D. $28 \%$
$\mathrm{CP}=5000 \mathrm{SP}=4000=\mathrm{CP}-\mathrm{SP}, 5000-4000=1000$
Loss $\%=$ Loss $\% / \mathrm{CP} \times 100$
$\%=1000 / 5000 \times 100=20 \%$
4. A shop sold a washing machine for Rs. 14999 . Find the cost price if he incurred a loss of $5 \%$.
$\mathrm{CP}=100 / 100-$ Loss $\% \times$ SP, Loss $\%=100-5=95 \%$
$=100 / 95 \times 14999=15788.50$
5. In a transaction, the profit percentage is $60 \%$ of the cost. If the cost further increases by $20 \%$ but the selling price remain the same, how much is the decrease in profit percentage?
$\mathrm{CP}=100$ Then Profit $=60 \mathrm{SP}=\mathrm{CP}+$ Profit $\%=100+60=160$
Cost increase $20 \%=$ New $\mathrm{CP}=120, \mathrm{SP}=160$
Profit $\%=\mathrm{SP}-\mathrm{CP}=160-120=40$

$$
\begin{aligned}
\% & =\text { Profit } \% / \mathrm{CP} \times 100 \\
& =40 / 120 \times 100=33.33 \%
\end{aligned}
$$

6. Hameed buys a colour T.V set for Rs. 15,200 and sells it at a loss of $20 \%$. What is the selling price of the T.V set?
A) Rs. 13,120
B) Rs. 12,108
C) Rs. $12,209 \mathrm{D})$ Rs. 12,160
$\mathrm{CP}=15200 \mathrm{SP}$ Loss\% $=20$ Loss $\%=100-20=80$

Selling Price: (S.P.)

$$
\begin{aligned}
\mathbf{S P} & =\left[\frac{(\mathbf{1 0 0}-\mathbf{L o s s} \%)}{\mathbf{1 0 0}} \times \mathbf{C . P} .\right] \\
\mathbf{S P} & =(100-20) / 100 \times 15200=80 / 100 \times 15200=152 \times 80=12160 \\
& =15200 \times 20 / 100=3040 \\
& =15200-3040=12160
\end{aligned}
$$

7. A man buys an item at Rs. 1200 and sells it at the loss of 20 percent. Then what is the selling price of that item
A. Rs. 660
B. Rs. 760
C. Rs. 860
D. Rs. 960
$=1200 \times 20 / 100=240$
$=1200-240=960$
8. A plot is sold for Rs. 18,700 with a loss of $15 \%$. At what price it should be sold to get profit of $15 \%$.
A. Rs 25300
B. Rs 22300
C. Rs 24300
D. Rs 21300

A plot rate $=\mathrm{x}$
Loss $\%=15-100=85$, Profit $\%=100+15=115$
$\mathrm{CP}=18700$
$=85: 18700=115: \mathrm{x}$
$\mathrm{X}=18700 \times 115 / 85=25300$
9. The cost price of 20 articles is the same as the selling price of x articles. If the profit is $25 \%$, find out the value of $x$
A. 13
B. 14
C. 15
D. 16

Cost price of a one article $=$ Rs. 1
CP of x article $=$ Rs. X
CP of 20 Article $=20$
Selling price of x article $=20$
Profit $=25 \%$
Profit $=20-\mathrm{x}$
Profit\% $=$ SP $-\mathrm{CP} / \mathrm{CP} \times 100$
$25=20-\mathrm{x} / \mathrm{x} / 1 \mathrm{X} 100=25 \mathrm{x} / 100=20-\mathrm{x} / \mathrm{x} / 4=20-\mathrm{x} / 5 \mathrm{x}-80=16$
10. If the cost price of 12 items is equal to the selling price of 16 items, the loss percent is
A. $20 \%$
B. $25 \%$
C. $30 \%$
D. $35 \%$

CP of 1 article $=$ Rs. 1
CP of 16 article $=16$
Selling price of 16 article $=12$ article
Loss $=16-12=4$
Loss\% $=4 / 16 \times 100=25 \%$
11. Sahil purchased a machine at Rs 10000 , then got it repaired at Rs 5000 , then gave its transportation charges Rs 1000 . Then he sold it with $50 \%$ of profit. At what price he actually sold it.
A. Rs. 22000
B. Rs. 24000
C. Rs. 26000
D. Rs. 28000
CP $=100$ Profit $\%=50$
Machine $=10000+5000+1000=16000$
$=150 / 100 \times 16000=24000$
12. If the cost price of 12 pens is equal to the selling price of 8 pens, the gain percentis ?
A. $12 \%$
B. $30 \%$
C. $50 \%$
D. $60 \%$
CP of 1 pen $=1$
Cost of 8 pens $=8$
Selling price of 8 pens $=12$
Profit $=12-8=4$
$=4 / 8 \times 100=50 \%$

## Simple Interest

## Formulas

$$
\text { S.I }=\frac{\mathrm{P} \times \mathrm{R} \times \mathrm{T}}{100}
$$

$\mathrm{P}=$ Principal, $\mathrm{R}=$ rate $\%, \mathrm{~T}=$ Time
Principal $=\frac{100 \times \mathrm{SI}}{\mathrm{R} \times \mathrm{T}}$
Rate $=\frac{100 \times \mathrm{SI}}{\mathrm{P} \times \mathrm{T}}$

$$
\text { Time }=\frac{100 \times \mathrm{SI}}{\mathrm{R} \times \mathrm{P}}
$$

## Examples

1. How much Simple Interest can a person get on Rs. 8,200 at $17.5 \%$ p.a. for a period of 2 years and 6 months?
A. Rs. 2,850
B. Rs. $3,587.50$
C. Rs. 3,750
D. Rs. $3,770.50$

Answer: B. Rs. 3,587.50
Explanation: S.I. $=(8200 * 2.5 * 17.5) / 100$

$$
=(8200 * 5 * 35) /(100 * 2 * 2)=\text { Rs. } 3587.50
$$

2. In what time will Rs. 4,000 lent at $3 \%$ per annum on simple interest earn as much interest as Rs. 5,000 will earn in 5 years at $4 \%$ per annum on simple interest?
A. $71 / 2$ years
B. $71 / 3$ years
C. $81 / 3$ yearsD. 9 years

Answer: C. 8 1/3 years
Explanation: $(4000 * 3 * R) / 100=(5000 * 5 * 4) / 100$

$$
\mathrm{R}=8 \mathrm{l} / 3
$$

3. A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is:
A. Rs. 590
B. Rs. 668
C. Rs. 698
D. Rs. 700

Answer: C. Rs. 698
Explanation: S.I. for 1 year $=$ Rs. $(854-815)=$ Rs. 39
S.I. for 3 years $=$ Rs. $(39 * 3)=$ Rs. 117

Therefore, Principal $=$ Rs. $(815-117)=$ Rs. 698
4. A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum?
A. Rs. 8,725
B. Rs. 8,825
C. Rs. 8,875
D. Rs. 8,925

Answer: D. Rs. 8,925
Explanation: Principal $=$ Rs. $(100 * 4016.25) / 9 * 5$
$=$ Rs. (401625 / 45)
$=$ Rs. 8,925
5. How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at $4.5 \%$ per annum of simple interest?
A. 3.6 years
B. 4 years
C. 4.6 years
D. 5 years

Answer: B. 4 years
Explanation: Time $=(100 * 81) /(450 * 4.5)=4$ years
6. A town has a population of 20,000 . The population increases by $10 \%$ per year. What will be the population after 2 years?

## Solution:

Here $\mathrm{R}=10 / 100$
$\mathrm{P}=20000$
$\mathrm{T}=2$
Population after 2 years will be $=\mathrm{P}(1+\mathrm{R} / 100)^{\mathrm{T}}$

$$
\begin{aligned}
& =20000(1+10 / 100)^{2} \\
& =20000(1.1)^{2} \\
& =24200
\end{aligned}
$$

7. The time required for a sum of money to amount to five times itself at $16 \%$ simple interest p.a. will be

## Solution:

Let the sum of money be Rs. $x$ and the time required to amount to five times itself be $t$ years.

So, the interest in ' t ' year should be Rs. 4 x .
In case of simple interest, we know,
$(\mathrm{P} \times \mathrm{T} \times \mathrm{r}) / 100=\mathrm{SI}$
Where, $\mathrm{P}=$ Principal amount, $\mathrm{T}=$ Duration in years, $\mathrm{i}=$ Interest rate per year, $\mathrm{SI}=$ Total simple interest

Then,
$\mathrm{x} \times \mathrm{t} \times 16 \%=4 \mathrm{x}$
$\Rightarrow \mathrm{t} \times(16 / 100)=4$
$\Rightarrow \mathrm{t}=400 / 16=25$
$\therefore$ The required time $=25$ years.
8. The rate of simple interest per annum at which a sum of money doubles itself in $16^{2} / 3$ years is:

## Solution:

Let the principal amount be P .
Now the amount A after $162 / 3$ years is doubled, hence amount is 2 P .
$\mathrm{I}=\mathrm{P} \times \mathrm{R} \times \mathrm{T} / 100$
Where,
$\mathrm{P}=$ principal amount
$\mathrm{R}=$ rate of interest
$\mathrm{T}=$ time in years $=162 / 3=50 / 3$
$\mathrm{I}=$ simple interest
Amount $\mathrm{A}=\mathrm{I}+\mathrm{P}$
According to question
$\mathrm{A}=\mathrm{P}+\mathrm{P} \times \mathrm{R} \times \mathrm{T} / 100$
$2 \mathrm{P}=\mathrm{P}+\mathrm{P} \times \mathrm{R} \times \mathrm{T} / 100$
$\mathrm{P}=\mathrm{P} \times \mathrm{R} \times \mathrm{T} / 100$
$\mathrm{R}=100 / \mathrm{T}$
$\mathrm{R}=100 \times 3 / 50$
$R=6 \%$
9. In how many years will a sum of Rs. 4,000 yield a simple interest of Rs. 1,440 at $12 \%$ per annum?

## Solution:

We know that, the formula for simple interest:
S.I. $=[P \times R \times T] / 100$

Where,
S.I. $=$ Simple Interest $=1440$
$\mathrm{P}=$ principal $=4000$
$\mathrm{T}=$ Time $=$ ?
$\mathrm{R}=$ Rate of Interest $=12 \%$

Substituting the values in the formula
$\Rightarrow 1440=[4000 \times 12 \times \mathrm{T}] / 100$
$\Rightarrow 1440=480 \mathrm{~T}$
$\Rightarrow \mathrm{T}=1440 / 480=3 \mathrm{yrs}$
10. A man took loan from a bank at the rate of $12 \%$ p.a. simple interest. After 3 years he had to pay Rs. 5400 interest only for the period. The principal amount borrowed by him was:
A) Rs. 2000
B) Rs. 10000
C) Rs. 15000
D) Rs. 20000

Answer: C) Rs. 15000
Explanation:
Principal $=$ Rs $(100 \times 5400 / 12 \times 3)=$ Rs. 15000

## Compound Interest

## Formulas

Annually CI = P ( $1+\mathrm{R} / 100$ )n
Rate of interest $=(\mathrm{A} / \mathrm{P})^{1 / \mathrm{T}}-1$
Compound interest half yearly $\mathrm{P}=(1+\mathrm{r} / 2 / 100)^{2 \mathrm{n}}$
Rate of interest $=2\left(\mathrm{P}^{1 / t}-1\right) \%$
Compound interest Quarterly $\mathrm{P}(1+\mathrm{r} / 4 / 100)^{4 \mathrm{n}}$
Compound interest monthly $\mathrm{P}(1+\mathrm{r} / 12 / 100)^{12 \mathrm{n}}$
CI when Rates are Different for Different Years
When rates are different for different years. Then, Amount $=\mathrm{P}(1+\mathrm{r} 1 / 100)(1+\mathrm{r} 2 / 100)$ ( $1+\mathrm{r} 3 / 100$ )

## Exampls $\mathbf{C l}$

1. A sum of Rs. 10000 is borrowed by Akshit for 2 years at an interest of $10 \%$ compounded annually. Calculate the compound interest and amount he has to pay at the end of 2 years.

## Solution:

Principal/ Sum $=$ Rs. 10000 , Rate $=10 \%$, and Time $=2$ years
Amount(A2) $=\mathrm{P}(1+\mathrm{R} 100)^{2}$
$\mathrm{A} 2=10000(1+10 / 100)^{2}=10000(11 / 10)(11 / 10)=$ Rs. 12100
Compound Interest (for 2nd year) $=$ A2-P $=12100-10000=$ Rs. 2100

Calculate the compound interest (CI) on Rs. 5000 for 2 years at $10 \%$ per annum compounded annually.
$\operatorname{Principal}(\mathrm{P})=$ Rs. 5000, Time $(\mathrm{T})=2$ year, Rate $(\mathrm{R})=10 \%$
Amount, $\mathrm{A}=\mathrm{P}(1+\mathrm{R} / 100) \mathrm{T}$
$\mathrm{A}=5000(1+10 / 100)^{2}=5000(11 / 10)(11 / 10)=50 \times 121=$ Rs. 6050
Interest (Second Year) $=\mathrm{A}-\mathrm{P}=6050-5000=$ Rs. 1050
2. The principle that amounts to Rs. 4913 in 3 years at $61 / 4 \%$ per annum C.I. compounded annually, is?
A. Rs. 3096
B. Rs. 4076
C. Rs. 4085
D. Rs. 4096

Answer: D. Rs. 4096
Principle $=[4913 /(1+25 /(4 * 100)) 3]$
$\Rightarrow 4913$ * $16 / 17$ * 16/17 * 16/17 = Rs. 4096
3. Find the Compound Interest on Rs. 8000 at $5 \%$ per annum for 3 years when C.I is reckoned yearly?
A. Rs. 1,185
B. Rs. 1,261
C. Rs. 1,346
D. Rs. 1,440

Answer: B. Rs. 1,261

$$
\mathrm{A}=8000(21 / 20)^{\wedge} 3=9261
$$

Now, $9261-8000=$ Rs. 1,261
4. The difference between simple interest and C.I. at the same rate for Rs. 5000 for 2 years in Rs.72. The rate of interest is?
A. $6 \%$
B. $8 \%$
C. $10 \%$
D. $12 \%$

Answer: D. 12\%

$$
\begin{aligned}
& 5000=72(100 / \mathrm{R})^{\wedge} 2 \\
& 5 \mathrm{R}^{\wedge} 2=720=>\mathrm{R}=12
\end{aligned}
$$

5. The difference between compound and simple interest on a certain sum of money for 3 years at $62 / 3 \%$ p.a is Rs.184. Find the sum?
A. Rs. 12,000
B. Rs. 13,500
C. Rs.14,200
D. Rs. 17,400

Answer: B. Rs.13,500

$$
\begin{aligned}
& \mathrm{P}=\left(184 * 10^{\wedge} 6\right) /[62 / 3 * 62 / 3 *(300 * 62 / 3)] \\
& \mathrm{P}=13500
\end{aligned}
$$

6. A sum of money is put out at compound interest for 2 years at $20 \%$. It would fetch Rs. 482 more if the interest were payable half-yearly, then it were pay able yearly. Find the sum.
A. Rs.1,000
B. Rs.1,250
C. Rs.2,000
D. Rs. 4,000

Answer: C. Rs.2,000
$\mathrm{P}(11 / 10)^{\wedge} 4-\mathrm{P}(6 / 5)^{\wedge} 2=482$
$\mathrm{P}=2000$
7. The difference between the compound interest compounded annually and simple interest for 2 years at $20 \%$ per annum is Rs. 144 . Find the principal?
A. Rs. 3,000
B. Rs.3,300
C. Rs.3,600
D. Rs.3,900

Answer: C. Rs.3,600
Explanation: $\mathrm{P}=144(100 / 5)^{\wedge} 2 \Rightarrow \mathrm{P}=3600$
8. Find the amount on Rs. 8000 in 9 months at $20 \%$ per annum, if the interest being compounded quarterly?
A. Rs. 9,021
B. Rs. 9,162
C. Rs.9,261
D. Rs. 9,621

Answer: C. Rs.9,261
Explanation: $\mathrm{A}=8000(21 / 20)^{\wedge} 3=9261$
9. Every year an amount increases by $1 / 8$ th of itself. How much will it be after two years if its present value is Rs. 64000 ?
A. Rs. 61,000
B. Rs. 65,000
C. Rs. 71,000
D. Rs. 81,000

Answer: D. Rs.81,000
Explanation: 64000*9/8*9/8 $=81000$
10. Indu gave Bindu Rs. 1250 on compound interest for 2 years at $4 \%$ per annum. How much loss would Indu has suffered had she given it to Bindu for 2 years at $4 \%$ per annum simple interest?
A. Rs. 10
B. Rs. 5
C. Rs. 3
D. Rs. 2

Answer: D. Rs. 2
Explanation: $1250=\mathrm{D}(100 / 4)^{\wedge} 2$
D $=2$

## Examples of Percentage questions

1. At an election, where there are two candidates only, a candidate who gets 43 per cent of the votes is rejected by a majority of 420 votes. Then total number of votes recorded assuming that there was no void vote are
A. 2700
B. 2800
C. 3200
D. 3000

## Option: D

Difference in $\%$ of votes $=57-43=14 \%$
$14 \%$ is represented by 420
Total number of votes $=420 *(100 / 14)=3,000$
2. A camera costing 2550 is marked to be sold at a price, which gives a profit of $30 \%$. What will be its selling price in a sale when $20 \%$ is taken off the marked price?
A. Rs. 600
B. Rs. 572
C. Rs. 35
D. Rs. 605

Option: B
$\mathrm{CP}=$ Rs. 550
$\therefore$ Marked price $=1.3 \times 550=$ Rs. 715
$\therefore$ Sales price $=0.8 \times 715=$ Rs. 572.
3. A man sells sugar to a tradesman at a profit of $20 \%$ but the tradesman becoming bankrupt pays only 80 paise in the rupee. How much percentage does the man gain or lose by his sale?
A. $2.5 \%$
B. $3 \%$
C. $4 \%$
D. $5.2 \%$

## Option: C

Let CP be Rs.x
$\mathrm{SP}=1.2 \mathrm{x}$ But he gets only $1.2 \mathrm{x} * 0.8=0.96 \mathrm{x}$
Loss $=0.04 \mathrm{x}$
Hence Loss \% = 4 .
4. Ram, Shyam and Ghanshyam invest Rs. 2000 , Rs. 10000 and Rs. 5000 to set up a stall. Ram gets $15 \%$ of the total profit for running the stall. Ram gets Rs. 500 less than Shyam and Ghanshym together, then total profit of that year is:
A. Rs. 1000
B. Rs. 2000
C. Rs. 1500
D. Rs. 3000

## Option: A

$85 \%$ of the total profit is divided in the ratio $2: 10: 5$.
$85 \%$ of total profit $=2 x+10 x+5 x=17 x$
Total profit $=(17 \mathrm{x} / 85 \%)$
Share of Ram in the profit $=2 x+15 \%$ of $20 x=2 x+3 x=5 x$
Share of Shyam in the profit $=10 \mathrm{x}$
Share of Ghanshyam in the profit $=5 \mathrm{x}$
Now, $(10 x+5 x)-5 x=500$
$10 \mathrm{x}=500$
$\Rightarrow \mathrm{x}=50$
$\therefore$ Total profit $=20 \times 50=$ Rs. 1000 .
5. Ram gets $55 \%$ of total valid votes in an election. If the total votes were 9000 , what is the number of valid votes that the other candidate Shyam gets if $30 \%$ of total votes were declared invalid?

## Solution:

Total votes $=9000$
Total valid votes $=70 \%$ of $9000=6300$
Shyam gets $45 \%$ of $6300=(45 / 100) * 6300=\mathbf{2 8 3 5}$ votes
6. Radha's salary is $50 \%$ more than Seeta's salary. Radha got a raise of $40 \%$ on her salary while Seeta got a raise of $30 \%$ on her salary. By what percent is Radha's salary more than Seeta's?

## Solution:

Let Seeta's salary $=$ Rs 100
Then Radha's salary $=100 * 50 \%+100=150$
Radha got a raise of $40 \%$ then $150 * 40 \%+150=210$
Seeta got a raise of $30 \%$ then $100 * 30 \%+100=130$
Now Radha salary more than Seeta salary by 80
Percent $=80 / 130 * 100=61.53 \%$
7. A student has to obtain $33 \%$ of the total marks to pass. He got 125 marks and failed by 40 marks. The maximum marks are :
A. 500
B. 600
C. 800
D. 1000

Answer: A) 500
Given that the student got 125 marks and still he failed by 40 marks
$\Rightarrow$ The minimum pass mark $=125+40=165$
Given that minimum pass mark $=33 \%$ of the total mark
$\Rightarrow$ total mark $=33 / 100=165$
$\Rightarrow$ total mark $=16500 / 33=500$
8. A man spends $35 \%$ of his income on food, $25 \%$ on children's education and $80 \%$ of the remaining on house rent. What percent of his income he is left with
A. $6 \%$
B. $8 \%$
C. $10 \%$
D. $12 \%$

Answer: B) 8 \%
Let the total income be x .
Then, income left $=(100-80) \%$ of $[100-(35+25)] \%$ of $x=20 \%$ of $40 \%$ of $x=[(20 /$ $100) *(40 / 100) * 100] \%$ of $x=8 \%$ of $x$.
9. If $75 \%$ of a number is added to 75 , then the result is the number itself. The number is :
A. 100
B. 200
C. 300
D. 400

Answer: C)
Let the number be x , Then
$75 \%$ of $x+75=x$
$\Rightarrow \mathrm{x}-75 \mathrm{x} / 100=75$
$\Rightarrow \mathrm{x}=300$.
10. Gaurav spends $30 \%$ of his monthly income on food articles, $40 \%$ of the remaining on conveyance and clothes and saves $50 \%$ of the remaining. If his monthly salary is Rs. 18,400 , how much money does he save every month ?
A. 3864
B. 4903
C. 5849
D. 6789

Answer: A) 3864
Saving $=50 \%$ of $(100-40) \%$ of $(100-30) \%$ of Rs. $18,400=$ Rs. $(50 / 100 * 60 / 100 * 70 /$ 100 * 18400) = Rs. 3864 .
11. 405 sweets were distributed equally among children in such a way that the number of sweets received by each child is $20 \%$ of the total number of children. How many sweets did each child recieve?
A. 9
B. 10
C. 11
D. 12

Answer: A) 9
Let the total number of children be x .

Then, $x *(20 \%$ of $x)=405$
$\Rightarrow \mathrm{x} * 20 \mathrm{x} / 100=405$
$15 \times 215 \times 2=405$
$\Rightarrow \mathrm{x}=45$
Number of sweets received by each child $=20 \%$ of $45=9$.
12. In a History examination, the average for the entire class was 80 marks. If $10 \%$ of the students scored 35 marks and $20 \%$ scored 90 marks, what was the average marks of the remaining students of the class?
A. 25
B. 50
C. 75
D. 100

Answer: C) 75
Let the number of students in the class be 100 and let this required average be x .
Then, $(10 * 95)+(20 * 90)+(70 * x)=(100 * 80)$
$\Rightarrow 70 x=8000-(950+1800)=5250$
$\Rightarrow \mathrm{x}=75$.
13. The population of a town was $1,60,000$ three years ago, If it increased by $3 \%, 2.5 \%$ and $5 \%$ respectively in the last three years, then the present population in
A. 155679
B. 167890
C. 179890
D. 177366

Answer: D) 177366
Present population $=160000 *(1+3 / 100)(1+5 / 200)(1+5 / 100)=177366$.

## Examples of Average related questions

The average of runs of a cricket player of 10 innings was 32 . How many runs must he make in his next innings so as to increase his average of runs by 4 ?
A. 76
B. 79
C. 85
D. 87

Answer: A) 76

## Explanation:

Average $=$ total runs $/$ no.of innings $=32$
So, total $=$ Average $\times$ no.of innings $=32 \times 10=320$.
Now increase in avg = 4runs. So, new avg $=32+4=36$ runs
Total runs $=$ new avg $\times$ new no. of innings $=36 \times 11=396$
Runs made in the 11th inning $=396-320=76$

A batsman makes a score of 87 runs in the 17th inning and thus increases his average by 3 .
Find his average after 17th inning?
Let the average after 7th inning $=x$
Then average after 16th inning $=x-3$

$$
\begin{aligned}
& 16(x-3)+87=17 x \\
& x=87-48=39
\end{aligned}
$$

The average of 7 consecutive numbers is 20 . The largest of these numbers is :
A. 21
B. 22
C. 23
D. 24

Answer: C) 23

## Explanation:

Let the numbers be $\mathrm{x}, \mathrm{x}+1, \mathrm{x}+2, \mathrm{x}+3, \mathrm{x}+4, \mathrm{x}+5$ and $\mathrm{x}+6$,
Then $(x+(x+1)+(x+2)+(x+3)+(x+4)+(x+5)+(x+6)) / 7=20$.
or $7 \mathrm{x}+21=140$ or $7 \mathrm{x}=119$ or $\mathrm{x}=17$.
Latest number $=x+6=23$.
The average weight of 8 persons increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg . What might be the weight of the new person?
A. 70 kg
B. 75 kg
C. 80 kg
D. 85 kg

Answer: D) 85 kg

## Explanation:

Total weight increased $=(8 \times 2.5) \mathrm{kg}=20 \mathrm{~kg}$.
Weight of new person $=(65+20) \mathrm{kg}=85 \mathrm{~kg}$.
A pupil's marks were wrongly entered as 83 instead of 63 . Due to that the average marks for the class got increased by half. The number of pupils in the class is :
A. 45
B. 40
C. 39
D. 37

Answer: B) 40

## Explanation:

Let there be x pupils in the class.
Total increase in marks $=(x * 1 / 2)=x / 2$.
$x / 2=(83-63) \Rightarrow x / 2=20 \Rightarrow x=40$.

The average weight of a class of 24 students is 35 kg . If the weight of the teacher be included, the average rises by 400 g . The weight of the teacher is :
A. 45 kg
B. 46 kg
C. 47 kg
D. 48 kg

Answer: A) 45 kg

## Explanation:

Weight of the teacher $=(35.4 \times 25-35 \times 24) \mathrm{kg}=45 \mathrm{~kg}$.
In an examination, a pupil's average marks were 63 per paper. If he had obtained 20 more marks for his Geography paper and 2 more marks for his History paper, his average per paper would have been 65 . How many papers were there in the examination?
A. 8
B. 9
C. 10
D. 11

Answer: D) 11

## Explanation:

Let the number of papers be x . Then, $63 \mathrm{x}+20+2=65 \mathrm{x}$ or $2 \mathrm{x}=22$ or $\mathrm{x}=11$.
The average temperature of the town in the first four days of a month was 58 degrees. The average for the second, third, fourth and fifth days was 60 degrees. If the temperatures of the first and fifth days were in the ratio $7: 8$, then what is the temperature on the fifth day?
A. 62 degrees
B. 64 degrees
C. 65 degreesD. 66 degrees

Answer: B) 64 degrees

## Explanation:

Sum of temperatures on 1st, 2nd, 3rd and 4th days $=(58 * 4)=232$ degrees
Sum of temperatures on 2nd, 3rd, 4th and 5th days $-(60 * 4)=240$ degrees
Subtracting (1) From (2), we get :
Temp, on 5th day - Temp on 1 st day $=8$ degrees.
Let the temperatures on 1st and 5th days be 7 x and 8 x degrees respectively.
Then, $8 \mathrm{x}-7 \mathrm{x}=8$ or $\mathrm{x}=8$.
Temperature on the 5th day $=8 x=64$ degrees.
The average age of students of a class is 15.8 years. The average age of boys in the class is 16.4 years and that of the girls is 15.4 years, The ratio of the number of boys to the number of girls in the class is :
A. $1: 2$
B. $2: 3$
C. $3: 4$
D. $4: 5$

Answer: B) $2: 3$

## Explanation:

Let the ratio be $\mathrm{k}: 1$. Then,

$$
\begin{aligned}
& \mathrm{k} * 16.4+1 * 15.4=(\mathrm{k}+1) * 15.8 \\
& \Leftrightarrow(16.4-15.8) \mathrm{k}=(15.8-15.4) \Leftrightarrow \mathrm{k}=0.4 / 0.6=2 / 3 .
\end{aligned}
$$

Required ratio $=2 / 3: 1=2: 3$.
David obtained 76, 65, 82, 67 and 85 marks (out of 100) in English, Mathematics,Physics, Chemistry and Biology What are his average marks ?
A. 75
B. 68
C. 65
D. 60

Answer: A)75

## Explanation:

Average $=(76+65+82+67+85) / 5=375 / 5=75$.
A motorist travels to a place 150 km away at an average speed of $50 \mathrm{~km} / \mathrm{hr}$ and returns at $30 \mathrm{~km} / \mathrm{hr}$. His average speed for the whole journey in $\mathrm{km} / \mathrm{hris}$ :
A. 35
B. 36
C. 37.5
D. 38.2

Answer: C) 37.5

## Explanation:

$$
\begin{aligned}
\text { Average speed }= & (2 \mathrm{xy}) /(\mathrm{x}+\mathrm{y}) \mathrm{km} / \mathrm{hr} \\
= & (2 * 50 * 30) /(50+30) \mathrm{km} / \mathrm{hr} \\
& 37.5 \mathrm{~km} / \mathrm{hr}
\end{aligned}
$$

The average monthly salary of 20 employees in an organisation is Rs. 1500. If the manager's salary is added, then the average salary increases by Rs. 100. What is the manager's monthly salary?
A. 3600
B. 3700
C. 3800
D. 3900

Answer: A) 3600

## Explanation:

Manager's monthly salary Rs. $(1600 * 21-1500 * 20)=$ Rs. 3600.
The average age of 15 students of a class is 15 years. Out of these, the average age of 5 students is 14 years and that of the other 9 students is 16 years, The age of the 15 th student is:
A. 11
B. 12
C. 13
D. 14

Answer: A) 11

## Explanation:

Age of the 15 th student $=[15 * 15-(14 * 5+16 * 9)]=(225-214)=11$ years.
In a class of 78 students 41 are taking French, 22 are taking German. Of the students taking French or German, 9 are taking both courses. How many students are not enrolled in either course?
A. 6
B. 12
C. 24
D. 18

Answer: C) 24

## Explanation:

You could solve this by drawing a Venn diagram. A simpler way is to realize that you can subtract the number of students taking both languages from the numbers taking French to find the number taking only French. Likewise find those taking only German. Then we have:Total = only French + only German + both + neither
$78=(41-9)+(22-9)+9+$ neither.
Not enrolled students $=24$
The average price of three items of furniture is Rs. 15000. If their prices are in the ratio 3:5:7, the price of the cheapest item is :
A. 6000
B. 7000
C. 8888
D. 9000

Answer: D) 9000

## Explanation:

Let their prices be $3 \mathrm{x}, 5 \mathrm{x}$ and 7 x .
Then, $3 \mathrm{x}+5 \mathrm{x}+7 \mathrm{x}=(15000 * 3)$ or $\mathrm{x}=3000$.
Cost of cheapest item $=3 \mathrm{x}=$ Rs. 9000 .
The average weight of a group of boys is 30 kg . After a boy of weight 35 kg joins the group, the average weight of the group goes up by 1 kg . Find the number of boys in the group originally?
A. 6
B. 8
C. 4
D. 5

Answer: C) 4

## Explanation:

Let the number of boys in the group originally be x .
Total weight of the boys $=30 \mathrm{x}$
After the boy weighing 35 kg joins the group, total weight of boys $=30 \mathrm{x}+35$

So $30 \mathrm{x}+35+31(\mathrm{x}+1) \Rightarrow \mathrm{x}=4$.
In a mixture of three varities of oils, the ratio of their weight is $4: 5: 8$. If 5 kg of oils of the first variety, 10 kg of the second variety and some quantity of oils of the third variety are added to the mixture, the ratio of the weights of three varieties of oils becomes as $5: 7: 9$ in the final mixture, find the quantity of third variety of oil was?
A. 15 kg
B. 25 kg
C. 35 kg
D. 45 kg

Answer: D) 45 kg

## Explanation:

Let the ratio of initial quantity of oils be ' $x$ ' $\Rightarrow 4 x, 5 x \& 8 x$.
Let k be the quantity of third variety of oil in the final mixture.
Let the ratio of initial quantity of oils be ' $y$ '
From given details,

$$
\begin{equation*}
4 x+5=5 y \tag{1}
\end{equation*}
$$

$5 \mathrm{x}+10=7 \mathrm{y}$
$8 x+k=9 y$
By solving (1) \& (2), we get $x=5 \& y=5$
From (3) $\Rightarrow \mathrm{k}=5$
Therefore, quantity of third variety of oil was $9 \mathrm{y}=9(5)=45 \mathrm{~kg}$.

## Ratio related questions

Salaries of Ravi and Sumit are in the ratio 2:3. If the salary of each is increased by Rs. 4000 , the new ratio becomes $40: 57$. What is Sumit's salary?
A. 38000
B. 46800
C. 36700
D. 50000

Answer: A) 38000

## Explanation:

Let the original salaries of Ravi and Sumit be Rs. 2x and Rs. 3x respectively.
Then,
$(2 \mathrm{x}+4000) /(3 \mathrm{x}+4000)=40 / 57$
$\Rightarrow 57 \times(2 x+4000)=40 \times(3 x+4000)$
$\Rightarrow 6 \mathrm{x}=68,000$
$\Rightarrow 3 \mathrm{x}=34,000$

Sumit's present salary $=(3 x+4000)=$ Rs. $(34000+4000)=$ Rs. 38,000
A mixture contains alcohol and water in the ratio $4: 3$. If 5 liters of water is added to the mixture, the ratio becomes $4: 5$. Find the quantity of alcohol in the given mixture.
A. 10
B. 12
C. 15
D. 18

Answer: A) 10

## Explanation:

Let the quantity of alcohol and water be $4 x$ litres and $3 x$ litres respectively
$4 \mathrm{x} /(3 \mathrm{x}+5)=4 / 5$
$20 \mathrm{x}=4(3 \mathrm{x}+5)$
$8 \mathrm{x}=20$
$\mathrm{x}=2.5$
Quantity of alcohol $=(4 \times 2.5)$ litres $=10$ litres.
Seats for Mathematics, Physics and Biology in a school are in the ratio 5:7:8. There is a proposal to increase these seats by $40 \%, 50 \%$ and $75 \%$ respectively. What will be the ratio of increased seats?
A. 1:2:3
B. $2: 3: 4$
C. 3:4:5
D. $4: 5: 6$

Answer: B) 2:3:4

## Explanation:

Originally, let the number of seats for Mathematics, Physics and Biology be $5 \mathrm{x}, 7 \mathrm{x}$ and 8 x respectively. Number of increased seats are ( $140 \%$ of $5 x$ ), ( $150 \%$ of $7 x$ ) and ( $175 \%$ of $8 x$ ).
$\Rightarrow[(140 / 100) \times 5 \mathrm{x}],[(150 / 100) \times 7 \mathrm{x}]$ and $[(175 / 100) \times 8 \mathrm{x}]$
$\Rightarrow 7 \mathrm{x}, 21 \mathrm{x} / 2$ and 14 x .
$\Rightarrow$ The required ratio $=7 \mathrm{x}: 21 \mathrm{x} / 2$ : 14 x
$\Rightarrow 14 \mathrm{x}: 21 \mathrm{x}$ : 28 x
$\Rightarrow 2: 3: 4$
Alloy A contains $40 \%$ gold and $60 \%$ silver. Alloy B contains $35 \%$ gold and $40 \%$ silver and $25 \%$ copper. Alloys A and B are mixed in the ratio of 1:4. What is the ratio of gold and silver in the newly formed alloy is?
A. $20 \%$ and $30 \%$ B. $36 \%$ \& $44 \%$
C. $25 \% \& 35 \%$ D. $49 \% \& 36 \%$

Answer: B) $36 \%$ and 44\%

## Explanation:

Assume the weight of alloy a is 100 kg
Therefore, The weight of alloy B is 400 kg

|  | Gold | silver | copper |
| :--- | :---: | :---: | :---: |
| A | 40 kg | 60 kg | 0 kg |
| B | 140 kg | 160 kg | 100 kg |
| total | 180 kg | 220 kg | 100 kg |

Therefore, Ratio of gold and silver in new alloy $=180 / 500: 200 / 500=36 \%: 44 \%$
In a college, the ratio of the number of boys to girls is $8: 5$. If there are 160 girls, the total number of students in the college is
A. 100
B. 250
C. 260
D. 416

Answer: D) 416

## Explanation:

Let the number of boys and girls be 8 x and 5 x .
Total number of students $=13 \mathrm{x}=13 * 32=416$.
The ratio of male and female in a city is $7: 8$ respectively and percentage of children among male and female is 25 and 20 respectively. If number of adult females is 156800 , what is the total population of the city?
A. $4,12,480$
B. $3,67,500$
C. $5,44,700$
D. $2,98,948$

Answer: B) 3,67,500

## Explanation:

Let the total population be ' p '
Given ratio of male and female in a city is $7: 8$
In that percentage of children among male and female is $\mathbf{2 5 \%}$ and $\mathbf{2 0 \%}$
$\Rightarrow$ Adults male and female $\%=\mathbf{7 5 \%} \boldsymbol{\&} \mathbf{8 0 \%}$
But given adult females is $=156800$
$\Rightarrow \mathbf{8 0 \%} \mathbf{( 8 p} / 15)=156800$
$\Rightarrow 80 \times 8 \mathrm{p} / 15 \times 100=156800$
$\Rightarrow \mathrm{p}=156800 \times 15 \times 100 / 80 \times 8$
$\Rightarrow \mathrm{p}=367500$

Therefore, the total population of the city $=\mathbf{p}=\mathbf{3 6 7 5 0 0}$
The ratio of the incomes of Pavan and Amar is $4: 3$ and the ratio of their expenditures are 3:2. If each person saves Rs. 1889, then find the income of Pavan?
A. 6548
B. 5667
C. 7556
D. 8457

Answer: C) 7556

## Explanation:

Let ratio of the incomes of Pavan and Amar be $4 x$ and $3 x$ and Ratio of their expenditures be $3 y$ and $2 y$
$4 x-3 y=1889 \ldots \ldots .$. I
and
$3 x-2 y=1889$ $\qquad$ II

I and II
$y=1889$
and $\mathrm{x}=1889$
Pavan's income $=7556$
There are 209 doctors and nurses in a hospital. If the ratio of the doctors to the nurses is 11 $: 8$, then how many nurses are there in the hospital?
A. 88
B. 96
C. 108
D. 121

Answer: A) 88
Explanation:
Given, The ratio of the doctors to the nurses is $11: 8$
Number of nurses $=8 / 19 \times 209=88$.
The incomes of two persons $A$ and $B$ are in the ratio 3:4. If each saves Rs. 100 per month, the ratio of their expenditures is $1: 2$. Find their incomes ?
A. 200,400
B. 100,300
C. 100,200
D. 150,200

Answer: D) 150, 200

## Explanation:

The incomes of A and B be 3 P and 4 P .
Expenditures $=$ Income - Savings
(3P-100) and (4P-100)

The ratio of their expenditure $=1: 2$
$(3 \mathrm{P}-100):(4 \mathrm{P}-100)=1: 2$
$2 \mathrm{P}=100 \Rightarrow \mathrm{P}=50$
Their incomes $=150,200$
Salaries of Karthik, Arun and Akhil were in the ratio $4: 5: 6$ respectively. If their salaries were increased by 50 per cent, 60 per cent and 50 per cent respectively, what will be the new ratio of the salaries of Akhil, Arun and Karthik ?
A. 6:8:9
B. 8:6:9
C. $9: 8: 6$
D. $6: 5: 4$

Answer: C) $9: 8: 6$

## Explanation:

Given the salaries are in the ratio of $4: 5: 6$
Now the salaries are increased by $50 \%, 60 \%$ and $50 \%$ respectively
The New ratio of salaries will be

$$
\begin{aligned}
4 \times(150 / 100): 5 \times(160 / 100): & 6 x(150 / 100) \\
& =6: 8: 9
\end{aligned}
$$

The new ratio of salaries of Akhil, Arun and Karthik is $9: 8: 6$
Rice worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety in the ratio 1 $: 1: 2$. If the mixture is worth Rs. 153 per kg , then the price of third variety of rice per kg ?
A. Rs. 571.25
B. Rs. 175.5
C. Rs. 751.75
D. Rs. 850

Answer: B) Rs. 175.5
Explanation: Let the price of required variety $=$ Rs. $\mathrm{P} / \mathrm{kg}$
Then, respective amounts were $\mathrm{m} \mathrm{kg}, \mathrm{m} \mathrm{kg}$ and 2 mkg
$=126 \mathrm{~m}+135 \mathrm{~m}+2 \mathrm{pm}=153 \times 4 \mathrm{~m}$
$\Rightarrow 2 \mathrm{p}=351$
$\mathrm{p}=175.5 / \mathrm{kg}$

## LETTER SERIES \& CODING AND DECODING

## Introduction:

Coding series is a logical arrangement of letters of English alphabet arranged in a specified pattern. In this, a series of letters, groups of letters or combination of letters and numbers is given. Each group or single element is called term. The terms of the series form a certain
pattern. So first required to identify this pattern and find the missing term in the given series which will satisfy the pattern.

## Important Table

| A | B | C | D | E | F | G | H | I | J | K | L | M |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 |
| Z | Y | X | W | V | U | T | S | R | Q | P | 0 | N |


| A | B | C | D | E | F | G | H | I | J |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| K | L | M | N | O | P | Q | R | S | T |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| U | V | W | $\times$ | Y | Z |  |  |  |  |
| 21 | 22 | 23 | 24 | 25 | 26 |  |  |  |  |

## Types of Coding \& Decoding:

- Letter series/coding
- Number Coding
- Number \& Letter coding
- Substitution coding
- Mixed letter coding
- Mixed number coding
- Analysis coding

1) Letter coding: In this type, letters of English alphabet are arranged in a particular pattern like reverse order of letters, skipping of letters, position of letters in alphabetical order etc.

## Example:

1) What is the next letter in the series $B, F, J, N$, $\qquad$ ?
2) $R$
3) $T$
4) $Q$
5) S

Answer:1) R

## Explanation:

$B=2, F=6, J=10, N=14$. Here the difference between the letter is 4 . So the answer is $14+4=18$ which is R .
2) What is the next letter in the series $B, C, E, G$, $\qquad$ ?

1) J
2) I
3) K
4) M

## Explanation:

$\mathrm{B}=2, \mathrm{C}=3, \mathrm{E}=5, \mathrm{G}=7$. Here the letters are consecutive primes. So the next prime number is 11 which is K .
3) What is the next letter in the series CNL, BLI, AJF, ZHC, yfz $\qquad$ ?

1) XDY
2) YFZ
3) YFA
4) $X F Y$

Answer: 2) YFZ

## Explanation:

$\mathrm{C}=3, \mathrm{~B}=2, \mathrm{~A}=1, \mathrm{Z}=26$.( Decreasing by 1 ) So next letter is 25 , which is Y .
$\mathrm{N}=14, \mathrm{~L}=12, \mathrm{~J}=10, \mathrm{H}=8 .($ Decreasing by 2$)$ So next letter is 6 , which is F .
$\mathrm{L}=12, \mathrm{I}=9, \mathrm{~F}=6, \mathrm{C}=3$. ( Decreasing by 3 ) So next letter is 26 , which is Z .
4) In a certain code 'MISSIONS' is written as 'MSIISNOS'. How is 'ONLINE' written in that code?
A) OLNNIE
B) ONILEN
C) NOILEN
D) LNOENI

## Answer: 1) OLNNIE

## Explanation:

First and last letter remain same. The others interchange their positions in pair of two. So, NL become LN IN become NI so code of ONLINE will be OLNNIE.

M I S S I O NS
123
O N L I N E
MSI S N O S OLN NIE
5) In a certain code 'ROAR' is written as 'URDU'. How is 'URDU' written in that code?
A) VXDQ
B) XUGX
C) ROAR
D) VSOV

Answer:B) XUGX

| A | B | C | D | E | F | G | H | I | J | K | L | M |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 |
| Z | Y | X | W | V | U | T | S | R | Q | P | 0 | N |

## XUGX

Explanation: Each letter moves +3 . Add 3 to each letter of URDU,so code of URDU will be XUGX.
2) Number coding: In this type of coding, we deal with questions, in which the letters of a word are replaced by certain other letters or numbers according to a specific pattern/rule to form a code. You are required to detect the coding pattern / rule and answer the questions that are asked, based on that coding pattern / rule.

1) If P A IN T is coded as 74128 and E X C E L is coded as 93596 , then how would you encode A C C E P T?
a) 455978
b) 547978
c) 554978
d) 735961

Answer: Clearly, in the given code, the alphabets are coded as follows :

| P | A | I | N | T | E | X | C | E | L |
| :--- | :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| 7 | 4 | 1 | 2 | 8 | 9 | 3 | 5 | 9 | 6 |

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So, in A C C E P T. A is coded as $4, \mathrm{C}$ as $5, \mathrm{E}$ as $9, \mathrm{P}$ as 7 and T as 8 . Hence, the correct code is 455978 and, therefore, the answer is a).
2) If $D$ is coded as 4 and $C O V E R$ is coded as 63 , then BASIS will be coded as?
a) 49
b) 50
c) 54
d) 55

Answer: Clearly, in the given code, $\mathrm{A}=1 . \mathrm{B}=2, \mathrm{C}=3 \ldots$ so that CO V ER is coed as $3+15+22+5+18=63$. $[\mathrm{C}+\mathrm{O}+\mathrm{V}+\mathrm{E}+\mathrm{R}]$

| A | B | C | D | E | F | G | H | I | J |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| K | L | M | N | O | P | Q | R | S | T |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| U | V | W | $\times$ | Y | Z |  |  |  |  |
| 21 | 22 | 23 | 24 | 25 | 26 |  |  |  |  |

Now, in B A S I S, B $=2, \mathrm{~A}=1, \mathrm{~S}=19$, and $\mathrm{I}=9$. Thus, B A S I S will be coeded as $2+$ $1+19+9+19=50$. Hence, the answer is b).
3) Number Letter coding:In this type of coding, alphabetical code values are assigned to the numbers. Let us see some examples and try and understand the concepts and tricks.

1) In a certain code, 2 is coded as P, 3 as N, 9 as Q, 5 as R, 4 as A and 6 as B. How is 599423 coded in that code?
599423 = RQQAPN
a) EIIDBC
b) R QPANB
c) EIMDB
d) R Q Q A P N
e) R P P B Q N

Answer: Clearly, as given 5 is coded as R, 9 as $\mathrm{Q}, 4$ as A, 2 as P and 3 as N. So, 599423 is coded as RQQAPN. Hence, the answer is (d).

1) In a certain code, 3456 is coded as ROPE, 15526 is coded as APPLE, then how is 54613 coded?
$3456=$ ROPE $15526=A P P L E=54613=\mathrm{POEAR}$
a) R P P E O
b) ROPEA
c) P O E A R d) P A R E Oe) None of these

Answer: Clearly, in the given figures, the numbers are coded as follows:
$\begin{array}{llllll}3 & 4 & 5 & 6 & 1 & 2 \\ \mathrm{R} & \mathrm{O} & \mathrm{P} & \mathrm{E} & \mathrm{A} & \mathrm{L}\end{array}$
Thus, 5 is coded as P, 4 as O, 6 as E, 1 as A and 3 as R. So, 54613 as coded as P O E A R. Hence, the answer is (c).
3) In a certain code, 15789 is written as X T Z A L and 2346 is written as N P S U. How is 23549 written in that code?
a) NP T U L
b) PNTSL
c) NPTSLd) NBTSL
$\begin{array}{ccccccccc}1 & 5 & 7 & 8 & 9 & 2 & 3 & 4 & 6 \\ \mathrm{X} & \mathrm{T} & \mathrm{Z} & \mathrm{A} & \mathrm{L} & \mathrm{N} & \mathrm{P} & \mathrm{S} & \mathrm{U}\end{array}$
$15789=\mathrm{XTZAL} 2346=\mathrm{NPSU}=23549=\mathrm{NPTSL}$
Thus, 2 is coded as N, 3 as P, 5 as T, 4 as S and 9 as L. So, 23549 is coded as N P T S L and the correct answer is c) N P T S L
3) If M O B I L I T Y is coded as 46293927 , then E X A M I N A T I O N is coded as?

| A | $B$ | $C$ | $D$ | $E$ | $F$ | $G$ | $H$ | $I$ | $J$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| $K$ | L | $M$ | $N$ | $O$ | $P$ | $Q$ | $R$ | $S$ | $T$ |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| $U$ | $V$ | $W$ | $\times$ | $Y$ | $Z$ |  |  |  |  |
| 21 | 22 | 23 | 24 | 25 | 26 |  |  |  |  |

a) 45038401854
b) 56149512965
c) 57159413955
d) 67250623076

Answer: Let $\mathrm{A}=1, \mathrm{~B}=2, \mathrm{C}=3, \ldots . \mathrm{X}=24, \mathrm{Y}=25, \mathrm{Z}=26$. Then, $\mathrm{M}=13=1+3=4$; $\mathrm{O}=15=1+5=6 ; \mathrm{L}=12=1+2=3 ; \mathrm{T}=20=2+0=2 ;$ and $\mathrm{Y}=25=2+5=7$.

So, M O B IL I T Y = 46293927. Similarly, E X A M I N A T I O N $=56149512965$ and the correct answer is b ).
4) Substitution coding: Under this type of coding particular objects are given code names.

1) If 'cook' is called 'butler', 'butler' is called 'manager', 'manager' is called 'teacher', 'teacher' is called 'clerk' and 'clerk' is called 'principal', who will teach in a class?
(A) Cook
(B) Butler
(C) Manager
(D) Teacher
(E) Clerk

Ans.Clearly, a 'teacher' teaches in a class and as given, 'teacher' is called is 'clerk'. So, a 'clerk' will teach in the class. Hence, the answer is (e).
2) If 'diamond' is called 'gold', 'gold' is called 'silver', 'silver' is called 'ruby' and 'ruby' is called 'emerald', which is the cheapest jewel?
(A) Dimond
(B) Silver
(C) Gold
(D) Ruby
(E) Emerald

We know that 'silver' is cheapest. But as given, 'silver' is called 'ruby'. So, 'ruby' is the cheapest. Hence, the answer is (d).
3) If 'eye' is called 'hand', 'hand' is called 'mouth', 'mouth' is called 'ear', 'ear' is called 'nose' and 'nose' is called 'tongue', with which of the following would a person hear?
(A) Eye
(B) Mouth
(C) Nose
(D) Ear
(E) Tongue

Ans. A person hears with his 'ear'. But as per the given information, 'ear' is called 'nose'. So, a person will hear with the 'nose'. Hence, the answer is (C).
4) If 'white' is called 'blue', 'blue' is called 'red', 'red' is called 'yellow' 'yellow' is called green 'green' is called 'black', 'black' is called 'violet' and 'violet' is called orange', what would be the colour of human blood?
(a) Red
(b) Green
(c) Yellow
(d) Violet
(e) Orange

Ans.The colour of the human blood is human blood is 'red' and as given, 'red' is called 'yellow'. so, the colour of human blood is 'yellow'.

Mixed letter coding:In this type of question, three or four complete messages are given in the coded language and the code for a particular word is asked. To analyse such codes, any two messages bearing the common word are picked up. The common code word will mean that word. Proceeding similarly by picking up all possible combinations of two messages the entire message can be analysed.

Example : 1
A) 'pitdarna' means 'you are good';
B) 'dartok pa' means 'good and bad';
C) 'timnatok' means 'they are bad'.

In that language, which word stands for 'they'?
A) na
B) tok
C) tim
D) pit

Ans-C
Good $=$ bad are good $=$ dar $\quad$ bad $=$ tok are $=n$
Ans $=\mathrm{C}($ they $=$ tim $)$
Dar, na, tok
2) In a certain code language
A) 'pitnasom' means 'bring me water';
B) 'najotod' means 'water is life';
C) 'tub od pit' means 'give me toy';
D) 'jolinkot' means 'life and death';

Which of the following represent 'is' in that language?
A) jo
B) na
C) $\operatorname{tod}$
D) lin

Ans $=C$
Solution: Water, life, me na, pit, jo water $=$ na, $\mathbf{l i f e}=\mathbf{j o} \mathbf{m e}=\mathbf{p i t}$ is $=\mathbf{t o d} \mathbf{A n s}=\mathbf{C}$
3) In a certain code language
A) 'podnajoc' means 'very bright boy';
B) 'tam nu pod' means 'the boy comes';
C) 'nu per ton' means 'keep the doll';
D) 'joc ton su' means 'very good doll';

Which of the following means 'bright' in that language?
A) joc
B) pod
C) ton
D) na

Boy, the, very doll, pod, ton, joc, nu bright=
Boy $=$ pod, the $=\mathbf{n u}$, very $=\mathbf{j o c}$, doll $=$ ton bright $=$ na
Ans $=\mathbf{D}$
4) In a certain code language, 'col tip mot' means 'singing is appreciable'; 'mot baj min' means 'dancing is good' and 'tip nopbaj' means 'singing and dancing', which of the following means 'good' in that code language ?
A) Not
B) min
C) baj
D) Can't be determined

Is, singing, dancing mot, tip, baj
Is $=$ mot singing $=$ tip dancing $=$ baj good $=\min$ Ans $=B$
Step 2: In the first and second statements, the common code word is 'mot' and the common word is 'is'.

So, 'mot' means 'is'. In the second and third statements, the common code word is 'baj' and the common word is 'dancing'. So, 'baj' means 'dancing'.

Thus, in the second statements, 'mint' means 'good'.
5) In a certain code, 'bi nie pie' means 'some good jokes' : 'nie bat lik' means 'some real stories' ; and 'pie liktol' means 'many good stories'. Which word in that code means 'jokes'?
A) Bi
B) nie
C) pie
D) Can't be determined

## Answer: A.bi

In the first and second statements, the common code word is 'nie' and the common word is 'some'. So, 'nie' means 'some'.In the first and thirdstatements, the common code word is 'pie' and the common word is 'good'. So, 'pie' means 'good'.
6) In a certain code language,
(A) 'pitdarna' means 'you are good'
(B) 'dartok pa' means 'good and bad'
(C) 'timnatok' means 'they are bad'

In that language, which word stands for 'they'?
Option :
A) Na
B) tok
C) tim
D) pit

Answer: C) tim
In the first and third statements, the common word is 'na' and the common word is 'are'. So, 'na' means 'are'.In the second and third statements, the common code word is 'tok' and the common word is 'bad'.So, 'tok' means 'bad'.Thus, in the third statements, 'tim' stands for 'they

## Mixed Number Coding -

In this type of questions, three or four complete messages are given in the coded language and the code number for a particular word is asked.

## Examples

1) In a certain code, ' 467 ' means 'leaves are green'; ' 485 ' means 'green is good' and ' 639 ' means 'they are playing'. Which digit stands for 'leaves' in that code?
(A) 3
(B) 5
(C) 6
(D) 7

Solution: In the first and second statements, the common code digit is ' 4 ' and the common word is 'green'. So, '4' means 'green'.

In the first and third statements, the common code digits is ' 6 ' and the common word is 'are'. So, '6' means 'are'.

Thus, in the first statement, ' 7 ' means 'leaves'.
2) In a certain code, ' 253 ' means 'books are old'; ' 546 ' means 'man is old' and ' 378 ' means 'buy good books'. What stands for 'are' in that code?
(A) 1
(B) 2
(C) 4
(D) 6

Ans: B
In the first and second statements, the common code digit is ' 5 ' and the common word is 'old'. So, '5' means 'old'.

In the first and third statements, the common code digit is ' 3 ' and the common word is 'book'. So, '3' means 'books'.

Thus, in the first statement, ' 2 ' means 'are'.
3) In a certain code, ' 247 ' means 'spread red carpet'; ' 256 ' means 'dust one carpet' and ' 234 ' means 'one red carpet'. Which digit in that code means 'dust'?
(A) 1
(B) 2
(C) 3
(D) 5

Ans: D
In the first and second statements, the common code digit is ' 2 ' and the common word is 'carpet'. So, '2' means 'carpet'.

In the second and third statements, the common code digit is ' 6 ' and the common word is 'one'. So, '6' means 'one'.

Therefore, in the second statement, ' 5 ' means 'dust'.
4) In a certain code language, ' 743 ' means 'mangoes are good', ' 657 ' means 'eat good food' and ' 934 ' means 'mangoes are ripe'. Which digit means 'ripe' in that language?
(A) 4
(B) 6
(C) 7
(D) 9

Ans: D
In the first and third statements, the common code digits are ' 4 ' and ' 3 ' and the common words are 'mangoes' and 'are'.

So, ' 4 ' and ' 3 ' are the codes for 'mangoes' and 'are'.
Thus, in the third statement, ' 9 ' means 'ripe'.
5) In a certain code, ' 247 ' means 'spread red carpet'; ' 256 ' means 'dust one carpet' and ' 234 ' means 'one red carpet'. Which digit in that code means 'dust'?
(A) 1
(B) 2
(C) 3
(D) 5

Ans: D
In the first and second statements, the common code digit is ' 2 ' and the common word is 'carpet'. So, ' 2 ' means 'carpet'.

In the second and third statements, the common code digit is ' 6 ' and the common word is 'one'. So, '6' means 'one'.

Therefore, in the second statement, ' 5 ' means 'dust'.
6) In a certain code, '467’ means 'leaves are green'; '485' means 'green is good' and '639’ means 'they are playing'. Which digit stands for 'leaves' in that code?
(A) 3
(B) 5
(C) 6
(D) 7

Ans: B
In the first and second statements, the common code digit is ' 5 ' and the common word is 'old'. So, '5' means 'old'.

In the first and third statements, the common code digit is ' 3 ' and the common word is 'book'. So, '3' means 'books'.

Thus, in the first statement, ' 2 ' means 'are'.

## Example of Codings

## Mixed Letter Coding

1. In a certain code language,
(A) 'picvicnic' means 'winter is cold'
(B) 'tonic re' means 'summer is hot'
(C) 're pic boo' means 'winter and summer'
(D) 'victho pa' means 'nights are cold'

Which word in that language means 'summer'?
A. nic
B. re
C. to
D. pic
E. vic

Answer: B .re
In statements B and C, the common code word is 're' and the common word is 'summer'.
So, 're' means 'summer'.
2. In a certain code language,
(A) 'pitnasom' means 'bring me water'
(B) 'najatod' means 'water is life'
(C) 'tub od pit' means 'give me toy’
(D) 'jolinkot' means 'life and death'

Which of the following represents 'is' in that language ?
A. jo
B. na
C. tod
D. lin

Answer: C .tod
In statements A and B, the common code word is 'na' and the common word is 'water'. So, 'na' means 'water'. In statements B and D, the common code word is 'jo' and the common word is 'life'. So, 'jo' means 'life'. Thus, in statements B, 'tod' represents 'is'.

## Letter coding

3. If in a certain language, MADRAS is coded as NBESBT, how is BOMBAY coded in that code?
A. CPNCBX
B. CPNCBZ
C. CPOCBZ
D. CQOCBZ E. None of these

Answer: B. CPNCBZ
Each letter in the word is moved one step forward to obtain the corresponding letter of the code.
4. In a certain code, TRIPPLE is written as SQHOOKD. How is DISPOSE written in that code?
A. CHRONRD
B. DSOESPI
C. ESJTPTF D. ESOPSID E. None of these

Solution: TRIPPLE $=$ SQHOOOKD
DISPOSE $=\mathrm{CHRONRD} \quad \mathrm{Ans}=\mathrm{A}$

| A | $B$ | $C$ | $D$ | $E$ | $F$ | $G$ | $H$ | $I$ | $J$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| $K$ | L | $M$ | $N$ | $O$ | $P$ | $Q$ | $R$ | $S$ | T |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| $U$ | $V$ | $W$ | $\times$ | $Y$ | $Z$ |  |  |  |  |
| 21 | 22 | 23 | 24 | 25 | 26 |  |  |  |  |

Answer: A. CHRONRD
Each letter in the word is moved one step backward to obtain the corresponding letter of the code.

## Number coding

5. If DELHI is coded as 73541 and CALCUTTA as 82589662 , how can CALICUT be coded?
A. 5279431
B. 5978213
C. 8251896
D. 8543691

Solution: DELHI $=73541$ CALCUTTA $=82589662$
CALICUT $=8251896$ Ans $=\mathrm{C}$
Answer: C. 8251896
The alphabets are coded as follows :

| D | E | L | H | I | C | A | U | T |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 7 | 3 | 5 | 4 | 1 | 8 | 2 | 9 | 6 |

So, in CALICUT, C is coded as $8, \mathrm{~A}$ as $2, \mathrm{~L}$ as 5 , I as $1, \mathrm{U}$ as 9 and T as 6 .
Thus, the code for CALICUT is 8251896 .
6. In a certain code, RIPPLE is written as 613382 and LIFE is written as 8192 . How is PILLER written in that code?
A. 318826
B. 318286
C. 618826
D. 338816

Solution: RIPPLE $=613382$ LIFE $=8192$

PILLER $=318826$ ANS $=\mathrm{A}$
Answer: A. 318826
The alphabets are coded as shown :

| R | I | P | L | E | F |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 6 | 1 | 3 | 8 | 2 | 9 |

So, in PILLER, P is coded as 3 , I as $1, \mathrm{~L}$ as $8, \mathrm{E}$ as 2 and R as 6 .
Thus, the code for PILLER is 318826.

## Number letter coding

7. In as a certain code, 15789 is written as EGKPT and 2346 is written ALUR. How is 23549 written in that code ?
A. ALEUT
B. ALGTU
C. ALGUT
D. ALGRT
E. None of these

Solution: 15789 = EGKPT $2346=$ ALUR

$$
23549=\text { ALGUT ANS }=\text { C }
$$

Answer: C. ALGUT
In the given codes, the numbers are coded as shown :

| 1 | 5 | 7 | 8 | 9 | 2 | 3 | 4 | 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E | G | K | P | T | A | L | U | R |

i.e., 2 as A, 3 as L, 5 as G, 4 as U and 9 as T. So, 23549 is coded as ALGUT.
8. In a certain code, a number 13479 is written as AQFJL and 5268 is written as DMPN. How is 396824 written in that code?
A. QLPNKJ
B. QLPNMF
C. QLPMNF
D. QLPNDF E. None of these

Solution: $13479=$ AQFJL $5268=$ DMPN

$$
396824=\text { QLPNMF } \quad \text { ANS }=\mathrm{B}
$$

Answer: B. QLPNMF
In the given codes, the numbers are coded as shown :

| 1 | 3 | 4 | 7 | 9 | 5 | 2 | 6 | 8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| A | Q | F | J | L | D | M | P | N |

i.e., 3 as Q, 9 as L, 6 as P, 8 as N, 2 as M and 4 as F. So, 396824 is coded as QLPNMF.

## Substitution code

9. If orange is called butter, butter is called soap, soap is called ink, ink is called honey and honey is called orange, which of the following is used for washing clothes?
A. Honey
B. Butter
C. Orange
D. Soap E. Ink

Ans $=$ E
Answer: E. Ink
Clearly, 'soap' is used for washing the clothes. But, 'soap' is called 'ink'. So, 'ink' is used for washing the clothes.
10. If air is called green, green is called blue, blue is called sky, sky is called yellow, yellow is called water and water is called pink, then what is the color of clear sky?
A. Blue
B. Sky
C. Yellow
D. Water
E. Pink

ANS=B
Answer: B . Sky
The colour of clear sky is 'blue' and as given, 'blue' is called 'sky'.
So, the colour of clear sky is 'sky'.

## Mixed Number coding

11. In a certain code language, ' 479 ' means 'fruit is sweet';
' 248 ' means 'very sweet voice' and
'637' means 'eat fruit daily'.
Which digit stands for 'is' in that code ?
A. 7 B. 9 C. 4 D. Can't be determined E. None of these

ANS $=\mathrm{B}$
Answer: B . 9
In the first and second statements, the common code digit is ' 4 ' and the common word is 'sweet'. So, ' 4 ' means 'sweet'. In the first and third statements, the common code digit is ' 7 ' and the common word is 'fruit'. So, ' 7 ' means 'fruit'. Thus, in the first statement ' 9 ' means 'is'.
12. In a certain code language, '123' means 'bright little boy',
' 145 ' means 'tall big boy' and
'637' means 'beautiful little flower'.
Which digit in that language means 'bright' ?
A. 1
B. 3
C. 4
D. 6
E. None of these
ANS = E

Answer: E. None of these
In the first and second statements, the common code digit is ' 1 ' and the common word is 'boy'. So, ' 1 ' means 'boy'. In the first and third statements, the common code digit is ' 3 ' and the common word is 'little'. So, ' 3 ' means 'little'. Thus, in the first statements, ' 2 ' means 'bright'.

## Coding \& Decoding Excise

1. If 'ski rps tri' stands for 'nice Sunday morning'; 'tehstirps' stands for 'every Tuesday morning' and 'ski ptrqlm' stands for 'nice market place', what would 'Sunday' stands for?
A. ski
B. rps
C. tri
D. qm
2. In a certain language, 'pre natbis' means 'smoking is harmful';
'vogdornat' means 'avoid harmful habit' and
'dorbisyel' means 'please avoid smoking'.
Which of the following means 'habit' in that language ?
A. $v o g$
B. nat
C. dor
D. bis
3. If 'gnr' tag zogqmp' stands for 'Seoul Olympic Organising Committee'; 'hytognremf' stands for 'summer Olympic games' and 'esmsdrhyto' stands for 'modern games history', what would be the code for 'summer'?
A. hyto
B. gnr
C. emf
D. zog
4. In a certain language, 'Mink Yang Pe' means 'Fruits are ripe';
'Pe Lao May Mink' means 'Oranges are not ripe' and
'May PeNue Mink' means 'Mangoes are not ripe'.
Which word in that language means 'Mangoes'?
A. May
B. Pe
C. Nue
D. Mink
5. In a certain code language, 'put tir fin' means 'delicious juicy fruit'; 'tie dip sig' means 'beautiful white lily' and 'siglon fin' means 'lily and fruit'.
Which of the following stands for 'and' in the language?
A. lon
B. sig
C. fin
D. None of these
6. In a certain language, 'pre natbis' means 'smoking is harmful';
'vogdornat' means 'avoid harmful habit' and
'dorbisyel' means 'please avoid smoking'.
Which of the following means 'habit' in that language ?
A. vog
B. Nat
C. Dor
D. bis
7. If in a code language, COULD is written as BNTKC and MARGIN is written as LZQFHM, how will MOULDING be written in that code?
A. CHMFINTK
B. LNKTCHMF
C. LNTKCHMF
D. NITKHCMF
8. In a certain code, COMPUTER is written as RFUVQNPC. How is MEDICINE written in the same code?
A. EOJDJEFM
B. EOJDEJFM
C. MFEJDJOE
D. MFEDJJOE
9. If VICTORY is coded as YLFWRUB, how can SUCCESS be coded?
A. VXEEIVV
B. VXFFHVV
C. VYEEHVV
D. VYEFIVV
10. In a certain code, TOGETHER is written as RQEGRJCT. In the same code, PAROLE will be written as
A. NCPQJG
B. NCQPJG
C. RCPQJK
D. RCTQNC
11. If BOMBAY is written as MYMYMY, how will TAMIL NADU be written in that code?
A. TIATIATIA
B. MNUMNUMNU
C. IATIATIAT
D. ALDALDALD
12. If ROSE is coded as 6821 , CHAIR is coded as 73456 and PREACH is coded as 961473 , what will be the code for SEARCH ?
A. 246173
B. 214673
C. 214763
D. 216473
13. If in a certain code, TWENTY is written as 863985 and ELEVEN is written as 323039 , how is TWELVE written in that code ?
A. 863203
B. 863584
C. 863903
D. 863063
14. If GIVE is coded as 5137 and BAT is coded as 924 , how is GATE coded ?
A. 5427
B. 5724
C. 5247
D. 2547
15. If PALE is coded as 2134 , EARTH is coded as 41590 , how is PEARL coded in that code?
A. 29530
B. 24153
C. 25413
D. 25430
16. If in a certain language if ENTRY is coded as 12345 and STEADY is coded as 931785 , then state which is the correct code for below word. TENANT
A. 956169
B. 196247
C. 352123
D. 312723
17. If in a certain language, 943 is coded as BED and 12448 is coded as SWEET, how is 492311 coded in that language ?
A. EDSWBS
B. TSWBDD
C. DSWTEE
D. EBDSWE
E. EBWDSS
18. In a certain language, 36492 is written as SMILE and 058 is written as RUN. How are the following figures coded in that language ? 33980
A. SSLNR
B. SSLRN
C. SLSNR
D. None of these
19. In a certain code, 3456 is coded as ROPE, 15526 is coded as APPLE, then how is 54613 coded ?
A. RPPEO
B. ROPEA
C. POEAR
D. PAREO
20. In a certain code, 15789 is written as XTZAL and 2346 is written as NPSU. How is 23549 written in that code ?
A. NPTUL
B. PNTSL
C. NPTSL
D. NBTSL
21. If sky is called sea, sea is called water, water is called air, air is called cloud and cloud is called river, then what do we drink when thirsty?
A. Sky
B. Air
C. Water
D. Sea
E. Cloud
22. If man is called girl, girl is called woman, woman is called boy, boy is called butler and butler is called rogue, who will serve in a restaurant?
A. Butler
B. Girl
C. Man
D. Woman
E. Rogue
23. If train is called bus, bus is called tractor, tractor is called car, car is called scooter, scooter is called bicycle, bicycle is called moped, which is used to plough a field?
A. Train
B. Bus
C. Tractor
D. Car
E. Moped
24. If rose is called popy, popy is called lily, lily is called lotus and lotus is called glandiola, which is the king of flowers ?
A. Rose
B. Lotus
C. Popy
D. Lily
E. Glandiola
25. If room is called bed, bed is called window, window is called flower and flower is called cooler, on what would a man sleep ?
A. Window
B. Bed
C. Flower
D. Cooler
26. In a certain code language, ' 479 ' means 'fruit is sweet';
' 248 ' means 'very sweet voice' and
'637' means 'eat fruit daily'.
Which digit stands for 'is' in that code ?
A. 7
B. 9
C. 4
D. None of these
27. In a certain code language, ' 381 ' means 'Hari is honest';
' 162 ' means 'Shashi is intelligent' and
' 948 ' means 'Hari should go'.
Which digit in that language means 'honest' ?
A. 3
B. 8
C. 1
D. 9
28. In a certain code language, ' 851 ' means 'good sweet fruit' ; ‘ 783 ' means 'good red rose' and ' 341 ' means 'rose and fruit'. Which of the following digits stands for 'sweet' in that language?
A. 8
B. 5
C. 1
D. 3
29. If in a certain code language, ' 324 ' means 'Light is bright', ' 629 ' means 'Girl is beautiful' and '4758' means 'I prefer bright clothes', which digit means 'Light' in that language ?
A. 3
B. 2
C. 4
D. 7
E. 5
30. In a certain code, ' 786 ' means 'study very hard', ‘ 958 ' means 'hard work pays' and ' 645 ' means 'study and work'.
Which of the following is the code for 'very'?
A. 8
B. 6
C. 7
D. None of these

## Blood Relationship

## What is blood relationship

Blood relation is a tree or hierarchy of the family structure or relationships namely, grandparents, parents, children, niece, nephew, etc.
$1^{\text {st }}$ Generation- Grand Father and grand Mother
$2^{\text {nd }}$ Generation- Father, Mother, Uncle, and Aunt
$3^{\text {rd }}$ Generation- Self, Sister, Brother, Brother in law and Sister in Law
$4 r^{\text {th }}$ Generation- Son, Daughter, Nephew and Niece

| Mother | Amma, Thayi |
| :--- | :--- |
| Father | Appa, Thande |
| Grand Mother or Mother's Mother | Ajje |
| Grand father or Mother's Father | Thatha, Ajja |
| son-in-law- Aaliya | Aaliya |
| daughter-in-law | Sose |
| Elder brother | Dodda Anna |
| Younger brother - | Thamma |
| Elder Sister | DoddaAkka |
| Younger sister | Thangi |
| brother in law | Bhava |
| brother's wife | Athige |
| Father's elder sister or sisters | Aathe |
| Father's brother in law | Maava |
| Sister-in-law | Nadini |


| Type of Relationship | Terminology in Use |
| :--- | :--- |
| Mother's or Father's son | Myself/Brother |
| Mother's or Father's daughter | Myself/Sister |
| Mother's or Father's brother | Uncle |
| Mother's or Father's sister | Aunt |
| Mother's or Father's father | Grandfather |
| Mother's or Father's mother | Grandmother |
| Son's wife | Daughter-in-law |
| Daughter's husband | Son-in-law |
| Husband's or wife's sister | Sister-in-law |
| Husband's or wife's brother | Brother-in-law |
| Brother's son | Nephew |
| Brother's daughter | Niece |
| Uncle or aunt's son or daughter | Cousin |
| Sister's husband | Brother-in-law |
| Brother's wife | Sister-in-law |
| Grandson's or Granddaughter's daughter | Great-granddaughter |

## Types of Blood Relationship

1. jumbled descriptions: a description of the relationship between two members of the family in a jumbled manner. One has to decode the jumbled descriptions to find the exact relationship by drawing a family tree.
Exmples: Pointing to a photograph of a boy Mr.Ram said, "He is the son of the only son of my mother." How is Mr Ram related to that boy?
A. Brother
B. Uncle
C. Cousin
D. Father

## Ans: D Father

Step 1: There is a photograph and Mr.Ram. The photograph is of a man and hence two squares are represented. But the relationship of Mr.Ram with the person in the photograph is not known yet.

Step 2: The second line says Mr Ram has a mother. Mr Ram is the only son of his mother and Ram has a son and that photograph belongs to Mr Ram's son.

The boy in the photograph is the only son of the son of Ram's mother i.e., the son of Ram. Hence, Ram is the father of the boy.Hence, option D is the correct answer.
2. Relational puzzle: the information about the family members in a simple and straightforward manner. The number of family members are more here and many times this section will have a union of two or three families.

Examples: Ravi is a son of Aman's father's sister. Sahil is the son of Divya who is the mother of Gaurav and grandmother of Aman. Ashok is the father of Tanya and grandfather of Ravi. Divya is the wife of Ashok.
How is Ravi related to Divya?

1. Nephew
2. Son
3. Grandson 4. Data inadequate

Solution: There is no requirement for drawing a family tree to solve this question. Since Divya is the grandmother of Aman and Aman and Ravi are cousins (from the first statement). Ravi should be a grandson to Divya. Hence, option C is the correct answer.
Question 1: How is Gaurav's wife related to Tanya?

1. Niece
2. Sister
3. Sister-in-law4. Mother

Solution: Since Divya is the wife of Ashok and Ashok is the father of Tanya. We already know the Divya is also the mother of Gaurav and Sahil, Gaurav and Tanya should be siblings. Hence Gaurav's wife will be sister in law to Tanya.
3. Coded relations: the relationships among the members of the family are represented by certain specific codes or symbols such as $+. \_\$, *, \&, \#, @,!$ etc. The answers are obtained
by decoded the relationships hidden in the symbols. The only tedious process here is to solve all the options to arrive at the final correct answer.

## Example:

Question 1: Read the following instructions:

1. $A+B$ indicates $A$ is the brother of $B ; A-B$
2. $A-B$ indicates $A$ is the sister of $B$ and $A-B$
3. $\mathrm{A} x \mathrm{~B}$ indicates A is the father of $\mathrm{BA}=\mathrm{B}$

Which of the following means that C is the son of M ?

1. $\mathrm{M}-\mathrm{NxC}+\mathrm{F}$
2. $\mathrm{F}-\mathrm{C}+\mathrm{NxM}$
3. $\mathrm{N}+\mathrm{M}-\mathrm{FxC}$
4. $\mathrm{MxN}-\mathrm{C}+\mathrm{F}$

Solution: Option A: According to this option $\mathrm{NxC}^{\text {indicates }} \mathrm{N}$ is the father of c . Hence it is wrong. Option B : According to this option C is the brother of N who is the father of M . Hence it is wrong. Option C: According to this option Fx C indicates F is the father of C. Hence it is wrong. Option D : According to this option M is the father of N who is the sister of C hence C and N are siblings and C is the brother of F so, C is male, Hence C is the son of M .

Option D is the correct answer.

## Examples

1. Pointing to a photograph, Vipul said, "She is the daughter of my grandfather's only son." How is Vipul related to the girl in the photograph?
A. Father
B. Brother
C. Cousin
D. Uncle
E. Grandson

Ans $=D$
2. Pointing to a girl in the photograph, Amar said, "Her mother's brother is the only son of my mother's father." How is the girl's mother related to Amar?
A. Mother
B. Sister
C. Aunt
D. Grandmother
3. Pointing to a gentleman, Deepak said, " His only brother is the father of my daughter`s father." How is the gentleman related to Deepak? A. Grandfather B. Father C. Brother-in-law D. Uncle 4. Pointing to a photograph, a woman says, "This man`s son`s sister is my mother-in-law." How is the woman`s husband related to the man in the photograph?
A. Grandson
B. Son
C. Son-in-law D
D. Nephew
5. $\mathrm{P} \times \mathrm{Q}$ means P is the sister of $\mathrm{Q} ; \mathrm{P}-\mathrm{Q}$
$\mathrm{P}+\mathrm{Q}$ means P is the father of $\mathrm{Q} ; \mathrm{P}=\mathrm{Q}$
$\mathrm{P}-\mathrm{Q}$ means P is the mother of $\mathrm{Q} . \mathrm{P}=\mathrm{Q}$
Which of the following means S is the aunt of T ?S (FS) T
A. $\mathrm{T} \times \mathrm{M}+\mathrm{S} \mathrm{T}-\mathrm{M}, \mathrm{M}-\mathrm{S}$
B. $\mathrm{S}+\mathrm{T} \times \mathrm{M} \mathrm{S}-\mathrm{T}, \mathrm{T}-\mathrm{M}$
C. $S \times M+T S-M$,
D. $S x M+R-T$

Solution: $\mathrm{M}=\mathrm{T} \mathrm{S}$ is the aunt of T means S is the sister of the father (M) of T Ans C
6. Pointing to Sam in a photograph Samridhi said " His brother's father is the only son of my grandfather" How is Samridhi relate to the Sam in the photograph?
A) Sister
B) Aunt
C) Mother
D) Daughter

Sam=Samridhi, Ans A
7. Pointing to a lady, Anuj said, "She is the only daughter of my mother's husband". How is the lady related to Anuj?
A) Mother
B) Grandmother
C) Wife
D) Sister

Ans D
8. A is the son of B. C is the brother of A. D is son of C. How is A related to D?
A) Grandfather
B) Father
C) Maternal Grand father
D) Uncle
$\mathrm{B}=\mathrm{A}, \mathrm{C}-\mathrm{A}, \mathrm{A} \& \mathrm{C}=\mathrm{B}, \mathrm{D}=\mathrm{C}, \mathrm{A}=\mathrm{D}$ is Uncle $\mathrm{Ans}=\mathrm{D}$
9. A is the brother of B and C. C is the husband of D . and E is the father of A , then what is the relation D with E ?
A) Daughter
B) Daughter in Law
C) Sister
D) Cousin
$\mathrm{E}=\mathrm{A}-\mathrm{B}-\mathrm{C}, \mathrm{C}-\mathrm{D}, \mathrm{E}=\mathrm{A}, \mathrm{D} \& \mathrm{E}=$ Daughter in law Ans $=\mathrm{B}$
10. $K$ says $O$ and $M$ are my brothers. $K$ says $Q$ is father of $M$. $K$ says $T$ is brother of my father. How is T related to M's mother?
A) Brother
B) Father
C) Brothers in Law
D) husband
$\mathrm{Q}=\mathrm{K}-\mathrm{O}-\mathrm{M}, \mathrm{Q}=\mathrm{M}, \mathrm{T}-\mathrm{Q}, \mathrm{T} \& \mathrm{M}$ mother $=$ Brother in law Ans $=\mathrm{C}$
11. A is B sister C is B mother D is Cs father E is Ds mother. Then how is D relate to A ?
A) Grandfather
B) grandmother
C) Daughter
D) Grand daughter
$\mathrm{E}=\mathrm{D}=\mathrm{C}=\mathrm{A}-\mathrm{B} \mathrm{D}=\mathrm{C}, \mathrm{D} \& \mathrm{~A}=$ Gran father Ans $=\mathrm{A}$
12. Indicating towards a photograph a man tells his friend, "She is the daughter of only son of my fathers wife" How is the woman in the photograph related to man?
A) Daughter
B) Mother
C) Sister
D) Cousin

Ans $=$ Daughter
13. A points to $B$ and says to lady $C$ "His mother is the only daughter of your father" if so, how is C relate to B ?
A) Mother
B) Daughter
C) Grandmother
d) son

A tells to C pointing towards B" B's Mother is the only daughter of your C father. C To B , Ans $=$ A Mother
14. Pointing to a photograph Raju said" She is the mother of my son's wife's daughter" How is lady related to Raju?
A) Uncle
B) Cousin
C) Son in Law
D) Father in law

Ans D
15. Raju introduced Smitha as " his son's maternal grandfather's only son's only sister's mother in law" How is Smitha related to Raju.
A) Mother
B) Mother in lawC) wife
D) Aunt
16. Introducing Reena, Monika said "She is the only daughter of my father's only daughter" How is monika's mother related to Reena?
A) Aunt
B) Niece
C) Mother
D) Grand Mother

Ans $=\mathrm{D}$
17. Pointing to a photograph Raghu said" She is the mother of my brother's son's wife's daughter" How is lady related to Raghu?
A) Cousin
B) Daughter in law
C) Uncle
D) Non of these

Ans $=B$
18. pointing to a lady in a photograph, meera said " Her father's only son's wife is my mother in law" How is Meera's husband related to that lady in the photo?
A) Nephew
B) Uncle
C) Son
D) Father

Ans=A
19. Pointing to a photo Nishant says" His father is the only son of my mother" Whose photo is it
A) Nishant
B) Nishant's Brother
C) Nishant's father
D) Nishant's son

Ans $=\mathrm{D}$
20) Suresh introduced a man as " He is the only son of the woman who is the mother of the husband of my mother" how is suresh related to the man?
A) Uncle
B) Son
C) Cousin
D) Nephew

Ans $=B$

## Directions Test

The first step for solving the questions utilizing the concept of 'directions' is to understand the direction chart, which has 8 directions.


Note:- If notmentionedwealways assumethat theperson isfacing north.
Shortcut Approach:-Torememberfourmain directions,alwaysremembertheword'NEWS.'

## Someother basics:

1. Bis to theeast of $\mathbf{A}$.


Bis to the west of $A$.

$B$ isto the north of $A$
$B$ isto the south of $A$

2. B is tothe North Eastof A.


B is tothe North West of $A$.

2. B isto the South East of A.

$B$ isto the South West of $A$


B

## Conceptof Degree



## Concept of Turn

Left turn = clockwiseturn
Right turn =Anticlockwise turn.
Let us understand it through pictorial representation


To Keep In Mind In Left Right Movement:

1. A person facing north, on taking left will face towards west and on taking the right turn to wards east.
2. A person facing west, on taking left will face towards south and on taking right turn towards north.
3. A person facing east, on taking left will face towards north and on taking the right turntowards south.
4. A person facing south,on taking left will face towards east and on taking the right turn towards west.

Note: When a question says moved towards left or rightside, we assumethat the movement is a tanangle of 90 degrees.

Keep in mind that when a person moves to his left side, he will move towards anti- clockwise direction and when a person moves to his right side, he will move towards clockwise direction.

When a question says if someone move towards left or right side, we assume that the movement is at an angle of 90 degrees.

Example:-A Person is walking towards east 50 meters then he turned towards his right and walks 100 meters. Later in the journey he turned towards his right direction and walks for 150 meters finally he turns right and walks 100 meters. What is his final direction?

## Solution:

1) The 1 st line in the question says that person walks 50 m east.
2) The 2 nd line says that he turns right and walks 100 m since he is facing east so his right wouldbe 'SOUTH' direction therefore he walks 100 m south.
3) The 3 rd line says that he turns right againan dwalks 150 m so right of south is west.
4) Further the question says that he finally turns right and walks 100 m so right of west direction is north

2. A person starts from point A goes 4 km towards East then he takes his left and goes 4 km , at last he takes his right and goes 3 km , reached point $B$, Now in which direction point $B$ with respect to point A.
A) North-West
B) North-East
C) North
D) West

## Correct Option: B

As per the given information, we can draw a figure as shown below:


We can clearly observe from the figure that point B is North-East of point A. Hence, option B is correct.
3. A man moves towards the west and then takes a left turn. After covering some distance in that direction, he takes a right turn and finally, takes another right turn. Which direction is the man facing now?
A) West
B) East
C) South
D) North

## Correct Option: D



He is facing north direction now, Hence, option D is correct.
4. Kundan travels 15 km towards south and then takes a left turn and travels 10 km further again he takes a left turn and travels 15 km further. How far is he from his original position?
A) 40 km
B) 25 km
C) 10 km
D) 15 km

Correct Option: C

$\mathrm{AD}=\mathrm{BC}=10 \mathrm{Km}$
Therefore he is 10 km away from the original position. Hence, option C is correct.
5. Ram drove 10 km towards North and then 5 km towards west by his car then he turned to the south and covered 3 km . Further he turned to east and moved 6 km finally he turned right and moved 7 km . How can far and in which direction is he from his starting point?
A) 2 km , East
B) 2 km , west
C) 2 km , southD) 1 km , East


Correct Option: D
We can clearly, observe from the figure that Ram is 1 km far from the starting point in the East direction. Hence, option D is correct.
6. Ratan walked 7 km from his home in north direction, then he took a left and walked 4 km . Then he took a right and walked 5 km . After taking another right he walked 4 km and reached at his friend's home.

Find how far and in which direction is his home from his friend's home?
A) 15 km , North
B) 8 km , South-east
C) 12 km , South
D) 6 km , North-west

## Correct Option: C

From the following image it is clear that his home is 12 km south from his friend's home.

7. Bonny moves 30 meters towards south then turns to his right and starts moving straight till he completes another 30 meters. Then turning to his left he moves for 20 meters. He again then turns to his left and moves for 30 meters. How far is he from his initial position?
A) 30 metres
B) 50 metres
C) 10 metres D) 60 meteres

Correct Option: B


We can clearly observe from the above figure that, Bonny is 50 m far from startingpoint. Option B is hence the correct answer.
8. Ritesh was standing at the gate of his school. From there he walked 5 km in north and then took a right and walked for 7 km . After that he took a left and walked 3 km . and turned to his left and walked 10 km . Then again he turned to his left and walked for 8 km and reached at his home.
Find how far and in which direction is his school from his home?
A) 3 km , north
B) 3 km , east
C) 3 km , westD) 5 km , west

## Correct Option: B

From the following image it is clear that his school is 3 km in the east direction from his home.


Hence option (B) is correct.
9. A man is facing North-West. He turns $90^{\circ}$ in the clockwise direction and then $135^{\circ}$ in the anticlockwise direction. In which direction is he facing now?
A) North
B) West
C) East
D) South

## Solution: West



A man is facing west. He turns $45^{\circ}$ in the clockwise direction and then another $180^{\circ}$ in the same direction and then $270^{\circ}$ in the anti-clockwise direction. Which direction is he facing now?
A) South
B) North-west
C) West
D) South-west

Ans $=\mathrm{D}$
10. A horse is facing north. It turns 90 degrees in the clockwise direction, then 180 degrees in the anti-clockwise and then another 90 degrees in the same direction. Which direction is the horse facing now?
A) East
B) South
C) Southwest D) Southeast


## Ans $=\mathbf{B}$

Explanation: Starting from the initial point facing north, the horse turns 90 degrees clockwise, which means it turns towards East. Similarly, the other directions can be considered and written as : EWS Thus, the direction it is facing now is South.
11. A man is facing towards the east. He turns 270 degrees clockwise and then takes a right turn. Finally, he turns 90 degrees anticlockwise. Which direction is he facing now?
A) West
B) South
C) North
D) East


Ans=A: C) North
12. Anil is facing the East. He then turns $90^{\circ}$ clockwise and then $135^{\circ}$ anti-clockwise. In which direction is he facing now?
A) North
B) West
C) North-East
D) South-West


Ans=C North-East

## UNIT - 6

## LOGICAL REASONING

## Assertion \& Reason

Meaning: Assertion means a statement and reason means an explanation about that particular statement.

## Assertion reason sort question has these five diverse cases. They are:

1. Both statement and reason are valid, reason is right clarification of assertion.
2. Both statement and reason are valid however reason is not a right clarify of assertion.
3. Assertion is valid however reason is false.
4. Assertion is false however reason is valid.
5. Both are false.

## Examples:

Assertion (A) : When common salt is kept open, it absorbs moisture from the air.
Reason (R): Common salt contains magnesium chloride.
A. Both $A$ and $R$ are true and $R$ is the correct explanation of $A$.
B. Both $A$ and $R$ are true but $R$ is NOT the correct explanation of $A$.
C. A is true but R is false.
D. A is false but $R$ is true.
E. Both A and R are false.

## Answer: Option A

## Explanation:

Magnesium chloride present in common salt is a deliquescent substance i.e., it absorbs moisture from the air the kept in open.

## Assertion (A) : Most of the Himalayan rivers are perennial.

Reason (R): They are fed by melting snow.
A. Both A and R are true and R is the correct explanation of A .
B. Both A and R are true but R is NOT the correct explanation of A .
C. A is true but R is false.
D. A is false but $R$ is true.
E. Both A and R are false.

## Answer: Option A

## Explanation:

Most Himalayan rivers originating Himalayan peaks are perennial because they are fed by the melting snow throughout the year.

Assertion (A) : The use of Chlorofluorocarbon carbons is banned throughout the world nowadays.

## Reason ( R ) : These chemicals cause skin cancer.

A. Both A and R are true and R is the correct explanation of A .
B. Both A and R are true but R is NOT the correct explanation of A .
C. A is true but $R$ is false.
D. A is false but $R$ is true.
E. Both A and R are false.

## Answer: Option C

## Explanation:

The use of Chlorofluorocarbons is banned nowadays because these cause holes in ozone layer through which ultraviolet rays penetrate and may cause skin cancer.

## Assertion (A) : Leaves of plants are green.

## Reason (R) : Plants contain Chromoplasts, the green pigment.

A. Both A and R are true and R is the correct explanation of A .
B. Both A and R are true but R is NOT the correct explanation of A .
C. A is true but R is false.
D. A is false but $R$ is true.
E. Both $A$ and $R$ are false.

Answer: Option C

## Explanation:

Leaves of plants are green because they contain the green pigment, chlorophyll. However, plants containschromoplasts but they are not green pigments.

## Assertion (A) : We prefer to wear white clothes in winter.

## Reason ( R ) : White clothes are good reflectors of heat.

A. Both A and R are true and R is the correct explanation of A .
B. Both A and R are true but R is NOT the correct explanation of A .
C. A is true but $R$ is false.
D. A is false but $R$ is true.
E. Both A and R are false.

## Answer: Option D

## Explanation:

We prefer to wear dark clothes in winter because they absorb the heat and keep the body warm. However, white clothes are good reflectors of heat and are worn in summer.

Assertion (A) : Mohammad-bin-Tughluq is called the 'wisest fool'.

## Reason (R) : He had wise plans but implemented them foolishly.

A. Both A and R are true and R is the correct explanation of A .
B. Both A and R are true but R is NOT the correct explanation of A .
C. A is true but R is false.
D. A is false but $R$ is true.
E. Both A and R are false.

## Answer: Option A

## Explanation:

$R$ provides the correct explanation of $A$.

## Calendar

## What is Calendar?

A Calendar is a chart or series of pages showing the days, weeks and months of a particular year, or giving particular seasonal information.

Ordinary year: Any year which 365 days is called an ordinary year.Ex: 2007,2009, 2019, 2021 etc.

Leap year: Any year which has 366 days is called a leap year.Ex: 2012, 2016 2020,2024 etc.

The division of the number 365 by 7 gives the quotient 52 and remainder 1 which indicates that an ordinary year has 52 weeks and one extra day. This extra day is referred to as an "odd day" throughout the calendar topics.

A leap year has 366 days, the division of the number 366 by 7 gives the quotient 52 and remainder 2. This indicates that a leap year has 52 weeks and 2 extra days. These two extra days are also referred to as "odd days".

## Concept of an Odd Day

## A number of odd days in a month

January has 31 days, irrespective of whether it's an ordinary year or leap year. The division of the number 31 by 7 provides the remainder 3 hence January has 3 odd days. On generalising, any month which has 31 days has 3 odd days and any month which has 30 days has 2 odd days.

The only exception happens is in the case of February. The February month of an ordinary year has 28 days, division of 28 by 7 provides zero as remainder. Hence, the number of odd days in February of an ordinary year will have 0 odd days and that of leap year will have 1 odd day as February in a leap year has 29 days.

The below table depicts the number of odd days in different months of a calendar year:

| Month | Number of odd days |
| :--- | :---: |
| January | 3 |
| February(ordinary/leap) | $(0 / 1)$ |
| March | 3 |
| April | 2 |
| May | 3 |
| June | 2 |
| July | 3 |
| August | 3 |
| September | 2 |
| October | 3 |
| November | 2 |
| December | 3 |

## Finding of odd days in centaury

Step 1: 100 years $=76$ ordinary years +24 leap years
We know that an ordinary year has 1 odd day and a leap year has 2 odd days. Hence, 76 ordinary years will have 76 odd days and 24 leap years will $24 * 2=48$ odd days. Adding both the results we get $76+48=124$ odd days in total.

Step 2: 100 years $=(76 \times 1+24 \times 2)$ odd days $=124$ odd days.
Dividing the total odd days 124 by 7 gives the quotient as 17 and a remainder as 5 . This indicates that 124 days had 17 weeks and 5 odd days.
Step 3: 100 years $=(17$ weeks + days $) 5$ odd days.
A number of odd days in 100 years $=5$.
Now decoding the number to the days of the week from the table gives the result that the number 5 stands for Friday.

Hence, the last day (December $31^{\text {st }}$ ) of the year 100 A.D was Friday.

## Extension of the logic

Similarly, one can find the last day of the other century years by extending the same logic.
If 100 years had 5 odd days, then logically 200 years should have 10 odd days. Since 10 is greater than 7 , the division of 10 by 7 gives the remainder 3 . Hence, the 200 years had 3 odd days, which means the last day of the year 200 was Wednesday.

Number of odd days in 200 years $=(5 \times 2)=10=(7+3)=3$ odd days.
If 100 years had 5 odd days and 200 years 10 odd days logically 300 years should have 15 odd days. The division of 15 by 7 indicates it has 1 odd day from the remainder which indicates it is Monday. Hence, the last day of the year 300 was Monday.

Number of odd days in 300 years $=(5 \times 3)=15 / 7=(14+1)=1$ odd day.
Logically, 400 years should have 20 odd days since $400^{\text {th }}$ year is a leap year as it is divisible by 400 . This year will have $20+1=21$ odd days, which when divided by 7 gives the zero $(0)$ as remainder. Hence, 400 years had 0 odd day and that was Sunday.

The logical approach for the next few years is shown in the table given below:

| Century | Number of odd days | Day of the week |
| :--- | :---: | :--- |
| 100 | 5 | Friday |
| 200 | 3 | Wednesday |
| 300 | 1 | Monday |
| 400 | 0 | Sunday |


| $500=(100+400)$ | $(5+0)=5$ | Friday |
| :--- | :--- | :--- |
| $600=(200+400)$ | $(3+0)=3$ | Wednesday |
| $700=(300+400)$ | $(1+0)=1$ | Monday |
| $800=(400+400)$ | $(0+0)=0$ | Sunday |
| $900=(400+500)$ | $(0+5)=5$ | Friday |
| $1000=(500+500)$ | $(5+5)=(7+3)=3$ | Wednesday |

## Decoded day of the week

The week always begins with Monday and hence Saturday and Sunday are referred to as weekends. In order to make the calculation easier and reduce its time during the exams.

The days of the week are coded as follows:

| Code of the day | Day |
| :---: | :---: |
| 0 | Sunday |
| 1 | Monday |
| 2 | Tuesday |
| 3 | Wednesday |
| 4 | Thursday |
| 5 | Friday |
| 6 | Saturday |

## Evaluation of Leap Year

The leap year occurs every four years, most of the time, but there are scenarios where the gap between two leap years was 8 years instead of the regular 4 years.

Ex: The year 1896 is a leap year. The next leap year comes in 1904 (1900 is not a leap year).

In order to make the investigation easier and faster, any year which is divisible by number 4 completely (remainder becomes zero) is considered as a leap year.

Ex: 1888, 2012, 2016 are leap years as it's completely divisible by 4. Years like 2009, 2019 etc. are not divisible by 4 completely hence they normal years.

## Examples

Question: If $17^{\text {th }}$ march 2008 was Monday, what was $1^{\text {st }}$ April 2012 ?
Solution: The total number of odd days from $17^{\text {th }}$ March 2008 to $17^{\text {th }}$ March 2012.

| 2008 (leap year) | 2 odd days |
| :---: | :---: |
| 2009 (ordinary year) | 1 odd day |
| 2010 (ordinary year) | 1 odd day |
| 2011 (ordinary year) | 1 odd day |
| Total odd days $=$ | 5 odd days |

Since $17^{\text {th }}$ march 2008 was Monday and $17^{\text {th }}$ march 2012 is 5 days more than Monday. Then adding 5 odd days to Monday, we get Saturday. Hence $17^{\text {th }}$ march to April $1^{\text {st }}$ we have 15 days. Saturday $+15=$ Sunday. Adding 15 days or $(15=14+1)$ to Saturday, we get the answer as Sunday.
Question: Which year in the future will have the same calendar exactly as 2009 ?
A. 2010
B. 2013
C. 2015
D. 2017

Solution: If the total number of odd days between any years is zero or it's a multiple of seven. Then, those two years will have the same calendar.

The total number of odd days is listed below:

| Year | Odd days |
| :---: | :---: |
| 2009 | 1 |
| 2010 | 1 |
| 2011 | 1 |
| 2012 | 2 |
| 2013 | 1 |
| 2014 | 1 |
| Total number of odd days $=7$ |  |

Hence, 2015 will have the same calendar as 2009. Option C is the correct answer.
If 6th March, 2005 is Monday, what was the day of the week on 6th March, 2004 ?
A. Sunday
B. Saturday
C. Tuesday
D. Wednesday

Answer: A) Sunday

Explanation: The year 2004 is a leap year. So, it has 2 odd days.
But, Feb 2004 not included because we are calculating from March 2004 to March 2005.
So it has 1 odd day only.
The day on 6th March, 2005 will be 1 day beyond the day on 6th March, 2004.
Given that, 6th March, 2005 is Monday.
6th March, 2004 is Sunday (1 day before to 6th March, 2005).
On 8th Dec, 2007 Saturday falls. What day of the week was it on 8th Dec, 2006?
A. Saturday
B. Friday
C. Monday
D. Tuesday

Answer: B) Friday
Explanation: The year 2006 is an ordinary year. So, it has 1 odd day.
So, the day on 8th Dec, 2007 will be 1 day beyond the day on 8th Dec, 2006.
But, 8th Dec, 2007 is Saturday
S0, 8th Dec, 2006 is Friday.
January 1, 2007 was Monday. What day of the week lies on Jan. 1, 2008 ?
A. Monday
B. Tuesday
C. Wednesday
D. Sunday

Answer: B) Tuesday
Explanation: The year 2007 is an ordinary year. So, it has 1 odd day.
1st day of the year 2007 was Monday
1 st day of the year 2008 will be 1 day beyond Monday
Hence, It will be Tuesday.
On 8th Feb, 2005 it was Tuesday. What was the day of the week on 8th Feb, 2004 ?
A. Tuesday
B. Saturday
C. Friday
D. Sunday

Answer: D) Sunday
Explanation: The year 2004 is a leap year. It has 2 odd days.
The day on 8th Feb, 2004 is 2 days before the day on 8th Feb, 2005.
Hence, this day is Sunday
How many leap years does 100 years have?
A. 25
B. 24
C. 4
D. 26

Answer: B) 24

Explanation: Given year is divided by 4, and the quotient gives the number of leap years.
Here, $100 \% 4=25$.
But, as 100 is not a leap year $=>25-1=24$ leap years.
The calendar of the year 2024 can be used again in the year?
A. 2030
B. 2052
C. 2048
D. 2036

Answer: B) 2052

## Explanation:

## NOTE :

Repetition of leap year $===>$ Add +28 to the Given Year.

## Repetition of non leap year

Step 1 : Add +11 to the Given Year. If Result is a leap year, Go to step 2.
Step 2: Add +6 to the Given Year.

## Solution :

Given Year is 2024, Which is a leap year.
So, Add +28 to the given year (i.e $2024+28$ ) $=2052$
Therfore, The calendar of the year 2024 can be used again in the year 2052.
Suppose today is Friday, what day of the week will it be 65 days from now?
A. Saturday
B. Sunday
C. Friday
D. Thursday

Answer: B) Sunday
Explanation: The day of the week repeats every 7 days.
Given today is Friday. Again Friday is repeated on the 7th day, 14th,... on 7 multiple days.
Hence, Friday is on the 63 rd day, as 63 is multiple of 7.
Now, the required day of the week on the 65th day is Sunday.
It was Sunday on Jan 1, 2006. What was the day of the week Jan 1, 2010?
A. Monday
B. Friday
C. Sunday
D. Tuesday

Answer: B) Friday
Explanation: On 31st December, 2005 it was Saturday.
Number of odd days from 2006 to $2009=(1+1+2+1)=5$ days.

On 31st December 2009, it was Thursday.
Thus, on 1st Jan, 2010 it is Friday

## Indian logic

## INDIAN PHILOSOPHY schools of thoughts

Aastika - Orthodox (Vedas believers) Vedas are primary sources of knowledge.
Nastika- Unorthodox( Vedas- non believers) Rejection of Vedas as primary sources of knowledge.

## Shad Darshanas

1. Samkhya- school of Dualism. (Consciousness and Matter)
2. Yoga - Neo Vedanta. (Meditation contemplation)
3. Nyaya - school of logic.(logic and analytical Philosophy)
4. Vaisheshika- School of empiricism. (few atomic building blocks).
5. Poorva Meemaamsa- school of Orthopraxy(right practice). (critical interpretation of the Vedas)
6. Uttara Meemaamsa (Vedanta)- (Dwaita, Adwaita, Vishistadwaita Shakti vishistadwaita). (The essence of the Vedas)
Aastika there is two divisions;
7. Theistic- Non rejection of God.
a) Yoga. Patanjali maharshi, Pranayama, meditation, and Samadhi for renunciation.
b) Poorva Meemaamsa: jaimini, explains Vedas are external and device of knowledge.
c) Uttara Meemaamsa: veda vyas explains the dynamic nature of soul, maya are creation.
8. a Theistic - Rejection of god.
a) Samkhya- Kapila Rishi , eliminate physical and mental pains and receive liberation.
b) Nyaya- Gautama Maharshi, logical quest for God, phases of creation.
c) Vaisheshika. Kanada Rishi, science of logic , futility of Maya.

Naastika who are rejection of Vedas as primary sources of knowledge.
a) Buddhism: Heterodox (different to and opposing generally accepted beliefs or standards:
b) Jainism; Doctrine
c) Charvka. Materialist (Bhautika vada)

1. Buddhism : divided into three major groups
a) Mahayana- Idol Worship.
b) Hinayana -
c) Vajrayana - symbols (aabhicharika)

Language - Pali- Tripitakas (Buddha"s teactings)
2. Jainism : divided into two groups.
a) shwetambara- who wears white clothes.
b) Digambara _ who roams naked.

Charvaka- school of Niyati. Rishi Brihaspati was the founder of this charvaka materialist School. The word chrvaka means "charu" means beautiful "vaka" means speaks and it is also called as Lokayata" in samskrit. The only source of knowledge is given the name "pratyaksha" and only anubhava is recognized here. Anubhava is direct perception.

## यावज्जीवेत् सुखं जीवेत्, ऋणं कृत्वा घृतं पिबेत् । <br> भस्मीभूतस्य देहस्य, पुनरागमनं कुतः?

The things and entities we don't perceive through our senses are said to be nonexistent. Therefore this school disproves a source of knowledge like the mind , consciousness and soul. They consider only the physical body existent . they consider inference to be invalid as it is just a leap into the darkness.

## II PRAMANAS

Pramanas Means of knowledge. Prama ""'प्रमाण" literally means "proof" and "means of knowledge", if refers to epistemology in Indian philosophy and

Is one of the key much debated fields of study in Buddhism and Jainism since ancient times.

It is a theory of knowledge and encompasses one or more reliable and valid means by which human beings gain acherate, true knowledge.

The focus of pramana is how correct knowledge can be acquired . how one knows, how one doesn't and to what extent knowledge pertinent about someone or something can be acquired.

## Types of Pramanas:

Ancient and Medieval Indian texts identify six pramanas are correct means of accurate knowledge and ti truths.

1. Pratyaksha - Perception.
2. Anumana - Inference.
3. Upamana - Comparison and Analogy.
4. Arthapatti - Postulation, derivation from circumstances.
5. Anupalabdhi - Non- perception. Negative -cognitive proof.
6. Shabda - word, testimony of past or present reliable exparts( Vedas).

## Pramanas:

The science and study of pramanas is called "nyaya pramanas" means "proof" and it is also a concept and field of Indian philosophy. The concept is derived from the Sanskrit root "prama " which means correct notion, true knowledge, basic Foundation accurate notion. Thus the concept Pramana implies that which is a "means of acquiring prama or are certain correct true knowledge".

## Advaita Vedanta Darshan has given six pramanas

## प्रत्यक्ष- Pratyaksha-

Pratyaksha that which is before one's Eyes perception is of two types external that arising from the interaction of five sense organs and worldly objects and internal perception of Innocence demand.

Internal perception of inner sense the mind. In Indian philosophy perception the first means of knowledge or pramanas. That enable a person to have correct congitions of the world.

Prathyaksha is of two kinds

1. Direct Perception Anubhava and
2. Remembered Perception Smriti or Memory.

## 2. अनुमान-Anumana:

> Anumana "measuring along some other thing" or "inference" little literally translated the word anumana means "knowing after".
$>$ it means the method by which knowledge is derived from another knowledge. It is an indirect mediate knowledge.
$>$ we have knowledge of an invariable relationship between Two things and on that basis while seeing one we deduce the presence the other.
> Thus Anumana refers to the logical process of gaining knowledge.
> The knowledge again is called inferential knowledge or the logical deduction.

## 3. उपमान- Upamana

Upamana "comparison" as the process by which the knowledge of A s similarity to B is gained from the perception of Bs similarity to A . which has been seen elsewhere.

This methodology is seen as distance from mere inference and is knowledge. 'Upamana is a distinct means of knowledge and cannot be clubbed under Anumana because we cannot have a universal proposition that a thing is similar to whatever is similar to it. such knowledge cannot be gained without the observation of the the two similar things together.

## - अर्थापत्तिः- Arthapatti:

Arthapatti " the incidence of a case" which means postulation, (assume to exist) supposition or presumption of a fact.

It is distinct valid method of mediate knowledge. It is in fact a method of assumption of an unknown fact in order to account for a known fact that is otherwise inexplicable.

Arthapatti by which obtain accurate knowledge of the world.
Arthapatti knowledge arrived at by circumstantial implication.

- राब्द - Sabda :

Shabda sound pramana is verbal testimony it is also you called "aapta vakya " (statement of a trustworthy person and a agama authentic word).

A verbal statement uttered or written it is man's most important instrument for transmitting knowledge. We learn mostly by means or word. An oral or written message is the universal mode of communication we constantly get various information direction and knowledge through words.
$>$ राब्द - Shabda verbal testimony as a means of obtaining knowledge. In the philosophical systems (Darshana) shabda is equated with the authority of the Vedas (the most ancient sacred scriptures) as the only infallible testimony. Since the Vedas are deemed to be e eternal authorless and absolutely infallible.
$>$ अनुपलब्धि:- Anupalabdhi to be a separate independent pramana. It literally means non apprehension. Non existence of a thing is apprehended by its non perception. By not seeing a jar in a place one knows that it is not there.

## Structure of Anumana

Anumana is a Sanskrit derived word which has the literally meaning inference i.e an opinion for conclusion that is formed because of a known fact or evidence. It is a combination of two word namely "Anu" (meaning of after) and "Mana" (meaning knowledge) i.e after knowledge. In the Indian School of logic which is known as 'Nyaya Shastra" inference is known to occupy a central and irreplaceable position hereby governing all the other positions. Anumana or inference made up from the five pillars or steps of the Indian system of deductive reasoning. They are

1. प्रतिज्ञा- The Proposition
2. हेतु:- The Reason.
3. उदाहरण- An Example.
4. उपनय-An Application.
5. निगमन- The conclusion.

This is the typical way of any anumana or inference. These five steps actually mean
$>$ The first step includes the logical assertion or proposition which has to be proven in general in order to move to the next step.
$>$ The second step is the reason for the proof of the other assertion.
$>$ The third is udaharana which means in example.
$>$ The fourth step of the deductive reasoning is "upanaya" or open an application of the proposed action.
> The fifth step is as mentioned "nigamana" which amounts to the. Outcome or the conclusion.

## Types of Anumana Anumana can be classified in total of five ways.

1. स्वार्थानुमानम्- Svarthanumana (inference for oneself) : In this type of anumana one does not requires any sort of formal procedure or at most may require the last three steps of the five.
2. परार्थानुमानम्- Parathanumana (inference for others) : In this type of anumana one requires to follow all the steps of the five in the methodical order.
3. पूर्ववत्- Poorvavat: This type of inference is used for an unabsorbed effect cause due to an observed effect of an action. (Inference based on previous experience of Universal fact between two things).
4. रोषवत्- Sheshavat : This type of inference is used for or and observed effect caused due to an unobserved effect "inference based on elimination".
5. सामान्यतोदृष्टत्वात् - Samanyatodrishtatvat : This is a special type of inference which is not based on any causation. It is based on the continuity of synchronization or rather simply; it is based on continuous coexistence "inference by means of analogy".

Three terms are usually associated with inference "Sadhya, Hetu and Paksha .
साध्य- Sadhya means the character or major term or linga.
हेतु - Hetu means the middle term.
पक्षता- Paksha means the minor term.

## There are five characteristics of middle term.

1. It must be present in the minor term "Pakshadharmata" e.g. smoke must be present in the hill.
2. It must be present in all positive instance in which the major terms is present. e.g smoke must present in the kitchen where fire exits.
3. It must be absent in all negative instances in which the major term is absent. e.g smoke must be absent in the lake in which fire does not exist "vipakshasattva".
4. It must be non incompatible with the minor term. e.g coolness of Fire "abadhita".
5. It must be qualified by the absence of contracting reasons which leeds to a contradictory conclusion. e.g the fact of being caused should not be used to prove the eternality of sound (aviruddha).

## हेत्वभासा: -HETVABHASAA:

In Indian logic a fallacy is called Hetvabasa. It means the middle term appears to be e reason but it is not a valid reason. All fallacies are materialfallacies. We have mentioned the five characteristics of a valid middle term when this are violated we have fallacies.

## Types of Hetvabhasa:

The breach of any of the above mentioned basic fundamentals give rise to the following hetvabhasa or fallacies.

1. सव्यभिचारः-Savyabhichara
2. विरुद्ध: - Viruddh (meaning against).
3. सत्प्रतिपक्षः- Sapratipaksha.
4. असिद्ध:- Asiddha (meaning unproven).
5. बाधित- Badhita. (meaning hindrance).
6. सव्यभिचारः - savyabhichara: This is the fallacy of irregular middle. The middle term will be regularly related to the major term. When middle is not uniformly correlated with the major term give rise to a savyabhichara for example
All birds are rational
Crow is a bird
Therefore crows are rational.
Hear the middle term is "birds" but it is not uniformly related to the major term "rationa'l the middle term in this example is related to both rational and non rational creatures.Therefore it is defective hetu.

## Types of Savyabhichara:

a) साधारण- Sadharana (middle term is broad in nature).
b) असाधारण- Asadharana (middle term is narrow in nature).
c) अनुपसंहारि- Anupasamhari (middle term is non-)exclusive .

## Hetavabasa fallacies of inference

## Structure of Anumana:

Anumana is a Sanskrit derived word which has the the literally meaning inference that is opinion are conclusion that is formed because of a known fact or evidence it is the combination of two words namely e Anu meaning of outer and Mana meaning knowledge that is

In the Indian School of logic which is known as Shastra inference is known to occupy a central and it is replaceable position hereby governing all the other positions anumana inference is made up from the five pillar are steps of the Indian system of deductive reasoning they are

1. The proposition
2. The reason
3. An example and application
4. The conclusion.
5. This is the typical way of any Hanuman or insurance now let us understand what do this 5 steps actually mean the first step includes the logical assertion

## UNIT - 7

## DATA INTERPREATION

Direction: Study the following table carefully and answer the questions based on it.
The following table shows the production of minerals for some years as given.

## Production (In thousand tonnes)

| Year | Aluminum | Lead | Nickel | Copper | Mica | Zinc | Iron-ore |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $1990-91$ | 200 | 48 | 226 | 222 | 56 | 94 | 1100 |
| $1991-92$ | 248 | 112 | 232 | 310 | 68 | 98 | 1120 |
| $1992-93$ | 306 | 160 | 238 | 298 | 60 | 108 | 1122 |
| $1993-94$ | 364 | 126 | 248 | 288 | 76 | 96 | 1132 |
| $1994-95$ | 410 | 188 | 246 | 314 | 84 | 114 | 1116 |
| $1995-96$ | 560 | 208 | 278 | 328 | 100 | 110 | 1124 |
| $1996-97$ | 620 | 234 | 368 | 372 | 92 | 120 | 1142 |

What is the average annual production of aluminium from $1990-91$ to $1996-97$ ?
A) 386.86 million tonnes
B) 368.86 million tonnes
C) 3.69 million tonnes
D) 36.89 million tonnes
$=200+248+306+364+410+560+620=2708 / 7=386.86$ million tone
$\mathrm{Ans}=\mathrm{A}$
For which metal the increase in the production of that metal is maximum than the previous year.
A) Iron ore
B) Aluminium
C) Nickel
D) Copper

Aluminium production in 1994 to $1995=560-410=150$ thousand tones
Correct Option: B
In aluminium production increase is maximum then previous year is $94-95$ to $95-96$ increase
$=560-410=150$ thousand tonnes.

The total production of all minerals in 1990 - 91 is increased by $\mathbf{2 5 \%}$ than 1989 90. While the production of cooper in 1989-90 is $\mathbf{1 5 \%}$ of the total production in 1989 - 90. What is the approximate production of cooper in 1989-90.
A) 234 thousand tonnes
B) 232 thousand tonnes
C) 236 thousand tonnes
D) 235 thousand tonnes
$1989=100$
$1990=125$
Total production 1990-91 $=200+48+226+56+94+110=1946$
Production of minerals $1989=1946 / 125 \times 100=1556.8(1989)$
Cooper production $1989=\frac{1556.8 \times 15}{100}=233.52$ thousand tones
Ans $=\mathrm{A}$
The production of Nickel in 1990 - 91 is what per cent to the production of Nickel in 1996 - 97
A) $63.41 \%$
B) $60.18 \%$
C) $61.11 \%$
D) $63.11 \%$
E) $61.4 \%$
$=1990$ and 1996 Nickel $=\frac{226 \times 100}{368}=61.4 \%$
Ans $=\mathrm{E}$
Correct Option: E
$\%$ production of Nikil in 1990-91 against 96-97 $=\frac{226}{368} \times 100=61.4 \%$
Hence, option E is correct.
The production of iron ore in 1990 - 91 is what per cent to the average of total production of iron ore in the given seven years?
A) $95 \%$
B) $96 \%$
C) $97 \%$
D) $98 \%$
E) $99 \%$
$1990=1100$
1990 TO $1996=1100+1120+1122+1132+1116+1124+1142=7856$
$=7856 / 7=1122.28$
$=\%$ PRODUCTION $=1100 / 1122.28 \times 100=98.01$ ANS $=D$

Direction : Study the following table chart carefully and answer the questions given beside.

The following table represents Maximum marks of five subjects and marks obtained by five students in five subjects.

| Students | Physics <br> (Out of 75) | Mathematics <br> (Out of 100) | Chemistry <br> (Out of 75) | Biology <br> (Out of 75) | English <br> (Out of 120) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Ragini | 56 | 65 | 45 | 38 | 95 |
| Rohan | 60 | 52 | 62 | 55 | 88 |
| Sohan | 50 | 78 | 70 | 58 | 88 |
| Mohini | 55 | 82 | 65 | 66 | 110 |
| Mohan | 42 | 96 | 64 | 72 | 104 |

Marks obtained by Ragini in Chemistry and Biology together is what percent of the marks obtained by Mohini in Physics and Mathematics together?
A) $66.23 \%$
B) $60.58 \%$
C) $58.34 \%$
D) $54.32 \%$

Ragini Marks in C \& B $=45+38=83$
Mohini Marks in P \& M $=55+82=137$
Required $\%=\frac{83}{137} \times 100=60.58 \%$ Ans $=B$
Correct Option: B
Marks obtained by Ragini in Chemistry and Biology together $=45+38=83$
Marks obtained by Mohini in Physics and Mathematics together $=55+82=137$
Reqd. $\%=\frac{83}{137}=60.58 \%$
Hence, option B is correct
Find the respective ratio of the marks obtained by all the students in Mathematics and marks obtained by all the students in Chemistry.
A) $293: 351$
B) $373: 306$
C) $351: 293$
D) $306: 373$

Math: $=65+52+78+82+96=373$
Che $=45+62+70+65+64=306$
Ans $=$ B 373:306
Correct Option: B

Marks obtained by all the students in Mathematics $=65+52+78+82+96=373$
Marks obtained by all the students in Chemistry $=45+62+70+65+64=306$
Required ratio $=373: 306$
Hence, option B is correct.
Find the overall percentage of Sohan in all the subjects.
A) $62.7 \%$
B) $58.4 \%$
C) $77.3 \%$
D) $79.1 \%$

All marks out of $=75+100+75+75+120=445$
Sohan Obtained marks $=50+78+70+58+88=344$
Required $\%=344 / 445 \times 100=77.3 \%$

## Correct Option: C

Total marks in all the subjects $=75+100+75+75+120=445$
Marks obtained by Sohan in all the subjects $=50+78+70+58+88=344$

$$
\text { Reqd. } \%=\frac{344}{445}=77.3 \%
$$

Hence, option C is correct.
Find the difference between percentage of marks obtained by Mohan in English and that of Rohan in Physics.
A) $6.67 \%$
B) $4.59 \%$
C) $5.53 \%$
D) $3.12 \%$

Mohan in English $=104 / 120 \times 100=86.67 \%$

$$
=\frac{104}{120} \times 100=256 / 3
$$

RohanIn Physics $=60 / 75 \times 100=80 \%$
Difference B/t $=86.67-80=6.67 \%$
Correct Option: A
Percentage of marks obtained by Mohan in English $=\frac{104}{120} \times 100=86.67 \%$
Percentage of marks obtained by Rohan in Physics $=\frac{60}{75} \times 100=80 \%$
Required difference $=86.67-80=6.67 \%$
Hence, option A is correct.

## Find the sum of marks obtained by Rohan in all the subjects.

A) 515
B) 427
C) 611
D) 317

Correct Option: D
Sum of marks obtained by Rohan in all the subjects $=60+52+62+55+88=317$
Hence, option D is correct.
Direction (Q. 1-5): Study the following table to answer the questions that are given below.

| Items of <br> Expenditure | Salary | Fuel and <br> Transport | Bonus | Interest on <br> Loans | Taxes |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2013 | 288 | 98 | 3.00 | 23.4 | 83 |
| 2014 | 342 | 112 | 2.52 | 32.5 | 108 |
| 2015 | 324 | 101 | 3.84 | 41.6 | 74 |
| 2016 | 336 | 133 | 3.68 | 36.4 | 88 |
| 2017 | 420 | 142 | 3.96 | 49.4 | 98 |

1. The ratio between the total expenditure on taxes for all the years and the total expenditure on Fuel and Transport for all the years respectively is approximate:
(A) $4: 7$
(B) $10: 13$
(C) $15: 18$
(D) $5: 8$

Taxes Exp $=83+108+74+88+98=451$
Fuel \& Transport Exp $=98+112+101+133+142=586$

$$
\frac{451}{586}=\frac{1}{1.3}=\frac{10}{13}=10: 13 \mathrm{Ans}=\mathrm{B}
$$

2. The total expenditure of the company on these items during the year 2015 is
(A) 544.44 Lakhs
(B) 501.11 Lakhs
(C) 446.46 Lakhs
(D) 478.87 Lakhs
3. What is the average amount of interest per year which the company had to pay during this period?
(A) 32.43 Lakhs
(B) 33.72 Lakhs
(C) 34.18 Lakhs
(D) 36.66 Lakhs
4. Total expenditure on all these items in 2013 was approximately what percent of the total expenditure in 2017 ?
(A) $62 \%$
(B) $66 \%$
(C) $69 \%$
(D) $71 \%$
5. The total amount of bonus paid by the company during the given period is approximately what percent of the total amount of salary paid during this period?
(A) $0.1 \%$
(B) $0.5 \%$
(C) $1 \%$
(D) $1.25 \%$

## Solutions

1. $(\mathrm{B})$ Required Ratio $=\frac{(83+108+74+88+98)}{(98+112+101+133+142)}=\frac{451}{589} \approx \frac{1}{1.3}=\frac{10}{13}$
2. (A) Total expenditure of the company during 2015
$=$ Rs. $(324+101+3.84+41.6+74)$ lakhs
$=$ Rs. 544.44 lakhs
3. (D) Average amount of interest paid by the company during the given period
$=\operatorname{Rs}\left[\frac{23.4+32.5+41.6+36.4+49.4}{5}\right]$ lakhs
$=\operatorname{Rs}\left[\frac{183.5}{5}\right]$ lakhs $=$ Rs. 36.66
4. (C) Required percentage
$=\left[\frac{(288+98+3.00+23.4+83)}{(420+142+3.96+49.4+98)}\right] \times 100$
$=$ Rs. $\left[\frac{495.4}{713.36}\right] \times 100 \approx 69.45 \%$
5. (C) Required percentage

$$
\begin{aligned}
& =\left[\frac{3.00+2.52+3.84+3.68+3.96}{288+342+324+336+420}\right] \times 100 \\
& =\left[\frac{17}{1710}\right] \times 100=1 \%
\end{aligned}
$$

## UNIT - 8

## INFORMATION \& COMMUNICATION TECHNOLOGY

## Introduction

Technological innovation is essential for human development. From the printing press to the computer, people have devised tools for facilitating learning and communication. Technology is not inherently good or bad, the outcome depends on how it is used. ICT stands for information and Communication Technology Includes a diverse set of technological tools and resources Used to communicate, create, disseminate, store and manage information Includes computers, internet , broadcasting technologies (radio, television and telephony.Transmission of information is into binary digits ( 0 or 1 )

## UNESCO'S Definition of IT:

## > IT branch of engg-use of computers and software to manage information

## BIRTH OF II WORD

The term IT first used be Leavitt and Whisler in an article published in the Harvard Business Review in 1958- to describe new technology that was emerging
> Technology, Manfred Kochen observed, impacts in three stages. First, it enables us to do what we are now doing, but better, faster and cheaper; second, it enables us to do what we cannot do now; and third, it changes our life styles.

## Historical Perspective

## Different Ages

$>$ Agricultural Age: The period up to the 1800s, when the majority of workers were farmers whose lives revolved around agriculture.
> Industrial Age: The period from the 1800s to 1957, when work processes were simplified through mechanization and automation.

The Evolution of the Information Age

|  | Agricultural Age | Industrial Age | Information Age |
| :--- | :--- | :--- | :--- |
| Time Period | Per-1800s | 1800s to 1957 | 1957 to present |
| Majority of Workers | Farmers | Factory workers | Knowledge workers |
| Partnership | People and land | People and machines | People and people |
| Principal Tool | Hand tools | Machines | Information technology |

## Agricultural Revolution (1770-1900)

> Phase - I: The first phase, completed by 1750-70, saw two developments: first, the introduction of new crops; second, a considerable rise in the productivity of labour.
$>$ Phase - II: Second phase, lasting from around 1770 to 1830 demand increased rapidly. The reorganization of the land through enclosure and the gradual growth of larger farms, brought a slow rise in productivity, and a growing trend towards regional specialization.
> Phase - III: Began in 1830, and sometimes called the second agricultural revolution, saw for the first time farmers using substantial inputs purchased off their farms, in the form of fertilizers for their land and artificial feedstuffs for their animals

## Industrial Revolution (1815-1914)

$>$ In some parts of the Great Britain there occurred a transition i.e. manual-labour-economy towards machine-based manufacturing. Because of the Industrial revolution that took place, urbanization started in the $19^{\text {th }}$ century. Thus townships had developed.
> The changes involved in industrial revolution are both technological as well as socio-economiccultural.
> The technological change included the use of new basic materials, chiefly iron and steel; new energy sources such as coal, steam, electricity, petroleum, etc.;
> A new organization of work known as factory system emerged.
> The Socio-Economic-Cultural changes as a result of industrial revolution can be summarized as:
> Improvement in techniques of agriculture;
$>$ Food storage;
> Increased international trade;
$>$ Shift in economic power from royalty to new industrial tycoons;
$>$ Emergence of new patterns of authority.
> Technological Revolution (A Continuation of Industrial Revolution)
> The World Wars brought in scarcity and nations were put to hunt for new methods of production, exploitation of new resources, invention of new technologies and creation of artificial commodities.
> There has been a growing specialization of production. The new scientific discoveries were put to industrial application. Mass production techniques were evolved
> Automation resulted in faster production and increased efficiency. New modes of transportation and communication made it possible for the world to come closer.
> Air transportation, satellite communication, nuclear energy, exploitation of outer space, improvement in agriculture, health, environment, etc. are some of the results of the technological revolution.

## Information Revolution (Increasing Role of Information)

$>$ Today, we are at the threshold of yet another revolution what is described as "Information Revolution". Since the invention of printing, there has been a continuous revolution in the generation, transfer and communication of information.
$>$ In order to meet the growing needs of information acquisition, processing, storage and dissemination, a large number of new technologies have been adopted and modified by information professionals from time to time, important among them are:

## Computer Technology; Communication Technology; and Reprographic Technology

## Electromechanical Age

Telegraph: invented in 1837
"Victorian Internet" - the telegraph was the first world communication system
Telephone: invented by Alexander Graham Bell in 1876
Radio: invented by Guglielmo Marconi in 1894
These inventions could communicate information, but not store it.

## What is Data and Information?

$>$ Data: Raw facts, figures, and details.
$>$ Information means facts, or details that tell you something about a situation, person, event etc.

Technology, Manfred Kochen observed, impacts in three stages. First, it enables us to do what we are now doing; but better, faster and cheaper; second, it enables us to do what we cannot do now; third, it changes our life styles.
> Longman's Dictionary of Contemporary English defines, Technology as, "new machines, equipment and ways of doing things that are based on modern knowledge about science and computers."

Figure 1.10 The Six Functions of Information Technology

> CAPTURE: The process of compiling detailed records of activities.
> PROCESSING: The process of converting, analyzing, computing, and synthesizing all forms of data or information.

- Data Processing
- Information Processing
- Word Processing
- Image Processing
- Voice Processing
> GENERATION: The process of organizing information into a useful form, whether as numbers, text, sound, or visual image.
>STORAGE AND RETRIEVAL: Storage is the computer process of retaining information for future use. Retrieval is the process by which a computer locates and copies stored data or information for further processing or for transmission to another user.

TRANSMISSION: The computer process of distributing information over a communications network.

- Electronic Mail, or E-Mail
- Voice Messaging, or Voice Mail


## Technology - Impact on Our Lives

> Technology has improved business effectiveness and reach
> Improved global access
> Faster productivity growth
> Improved efficiency
> Reduced costs

## References

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## INTRODUCTION TO COMPUTER

## Introduction

$>$ The creation of computer was in a sense the culmination of several centuries of technological innovation.
$>$ Today, there is hardly any field of human activity where computer does not find its application.
$>$ For the last one and half decades or so, computers are being used in India, in airlines operations, in railways, in banking sector and in other industrial fields.

## What is a Computer?

$>$ Historically speaking the word computer has been derived from the Latin word 'computere', which means to calculate.
> Therefore, the term computer can logically be applied to any calculating device.
$>$ However, in technical parlance, the term has come to refer specifically an electronic device.
$>$ As generally understood computer has some defined characteristics. These are:
$>$ It is an electronic device: Electronic devices (transistors, resistors, diodes) are used as component parts in making a computer.
> It has internal storage: Computer has an internal storage (memory) for storing both the program as well as the data processed by the computer.
$>$ It has a stored program: Every computer has a program of instructions, which specifies the sequence of operations to be followed, stored in its internal memory. It is this stored program which makes the computer automatic because the entire set of steps to be taken is determined in advance and no human intervention is required during its execution.
$>$ Although there are many shapes and sizes and prices, computers have some features which are common.
$>$ Firstly, computers are able to store internally not only the information to process, but also the set of instructions which tells them how to process it.
$>$ Secondly, computers are extremely fast. Since the computer processes information electronically without the use of mechanical moving parts, it can, in principle, process several millions of instructions in a second.
> Thirdly, computers process information in coded form. Information is often prepared for computer processing by using a keyboard, and is automatically converted into coded form (analog to digital).

## Historical Development of Computers

## First Step in Computing

$>$ About 3000 B.C. a simple instrument called 'Abacus' was invented. Abacus is made from the Latin word 'Abac' whose meaning is the plain surface of sand.
$>$ This was the first instrument used for computing.

> This simple instrument changed the world of computing. There is no record from where the abacus was invented. But the earliest form of this was used in Mesopotamia.
> Many countries are still using this instrument these days.
$>$ Abacus can perform the calculations of addition and subtraction very well, but it is difficult to perform the calculations of multiplication and division.
$>$ Also this instrument was not able to store the calculated results.

## Schickard's Calculator

In 1630 a German mathematician Wilhelm Schickard designed a mechanical calculator which was able to do simple arithmetic calculations like addition, subtraction, multiplication and division of numbers.


## Pascal's Calculator (Pascaline)

After fifteen years (1945) of Schickard's calculator a famous philosopher and mathematician Blaise Pascal of France invented a calculator, which was known as 'Pascaline'. Blaise Pascal made many changes in this instrument but his instrument couldn't get success. The reason was its high cost.


## Lebnitz's Calculator

> In 1671 Blaise Pascal's 'Pascaline' was further improved by the great German Scientist Gaut Fraid Lebnitz.
> This machine was able to do arithmetic calculations very simply.
$>$ After the invention of this calculator there was a long dark period of about one hundred and fifty years. In this dark period no such serious effort was made

## Babbage's Engine

> In 1823 a great British mathematician Professor Charles Babbage of Cambridge University, Britain began work with the help of British Government and developed a machine called 'Difference Engine'.
> This was a mechanical machine and was able to perform algebraic, arithmetic and statistical calculations.
$>$ This Difference Engine incorporated four parts
> An Input / Output device for inputs and outputs
$>$ A memory unit for storage
> A mill for process
$>$ A sequential program controller to control the process.
> Modern computers also use the similar concept.
$>$ For this pioneering concept he is known as the 'Father of Computers' in computer world.
$>$ But the main drawback of this machine was that it was very difficult to understand by other scientists due to its complicated structure.
> Charles Babbage was not satisfied with his 'Difference Engine' so he made many changes and after ten years he invented a more advanced machine called 'Analytical Engine'.
$>$ This was the first step in the automation of computing and is an ideal for today's computer scientists.
$>$ The next landmark in this direction was the effort of Herman Hollerith, who first developed electromechanical calculating machines in 1890.
> These machines used punched card input arid performed simple arithmetic calculations and card sorting operations.
> They were controlled by hand wired control panels.
$>$ In 1920s and early 1930s significant advances in punched card equipment resulted in machines that could not only perform addition and subtraction, but also multiplication.
$>$ With these enhanced capabilities these machines were used for record keeping and accounting functions.
> That was the reason why such machines were referred to as 'accounting machines'.

## IBM - MARK 1

$>$ In the year 1944 ASCC (Automatic Sequenced Controlled Calculator) later known as "IBMMARK1" was an electro-mechanical machine.
$>$ Punched cards were fed into the machine and results were output into a punched card machine or electronic type writer, connected to the machine.
> ASCC was a very large machine and was able to perform all types of mathematical calculations.
> The name of this machine indicates that this was the calculator but actually this machine was able to take decisions independently.

## Electronic Numerical Integrator And Calculator (ENIAC)

$>$ In 1945 Sir Ambrose Fleming developed the Vacuum Tube, were used as electronic switches.
> Vacuum tubes were electronic devices and made of glass tubes.
> In the year 1946 two American Scientists J. Presper Eckert and John Mauchly developed the world's first electronic computer. They named it ENIAC (Electronic Numerical Integrator And Calculator).
$>$ ENIAC contained about 18,000 Vacuum tubes and about 6000 switches. This machine was about 5000 times faster than the IBM-MARK1.
$>$ But the there were many disadvantages of this machines like, the size of the machine was very large while the memory was very small.
$>$ This machine consumed very high power (in many kilowatts).
> Major disadvantage of this machine was that it produced a large amount of heat, due to this everyday one or more tubes burnt and the replacement of these tubes was very difficult.
$>$ Also it was very difficult to work on this machine for a long time continuously due to heat.
$>$ To eliminate the problems created due to overheat it used air-conditioned environment.
IBM - $\mathbf{7 0 9 0}$
$>$ In 1948 a new type of technology was invented by a team of three scientists of AT \& T Bell Laboratory of U.S.A. They named it Transistor Technology.
> These transistors changed the world of electronics. The working of these transistors was similar to Vacuum tubes in many ways.
$>$ Transistors consumed very low electricity and reduced the size of different instruments.
> Vacuum tubes were made of glass and used different gases inside it, whereas transistors were made of solid metal, so it was very easy to transport electronic instruments based on transistors rather than Vacuum tubes.
$>$ Transistors also reduced the size of electronic instruments very much in comparison to instruments based on Vacuum tubes.
$>$ To use this technology IBM Corp. developed the world's first computer, completely based on transistors.

IBM Corp named it 'IBM-7090'. This computer was smaller in size in comparison to earlier computers and was able to run for many hours continuously.
$>$ After the invention of transistors many scientists started their research.
$>$ The aim of research was to reduce the size of various electronic instruments.
> In this race, a scientist J.S. Kilvi of Texas Instruments Co. of USA invented Integrated Circuit (IC) chip in the year 1958.
> These IC chips are very smaller in size than the transistors.
> These chips are further improved and known as LSI (Large Scale Integration) and VLSI (Very Large Scale Integration).
> Today's computers are completely based on these chips.

## Classification of Computers

$>$ Since computer has become very popular, there are various types of computers available these days. These computers can be classified in various categories as follows:
> Classification by Generation
> Classification by Principle
> Classification by Size

## 1. Classification by Generation

$>$ Computers can be classified in five generations. These are:
$>$ First Generation (1946-59)
> Second Generation (1959-1965)
> Third Generation (1965-1970)
> Fourth Generation (1970-1995)
> Fifth Generation (1995 onwards)

## a. First Generation (1946-1959)

$>$ First generation computers used valve technology (i.e. vacuum tubes).
$>$ The development of vacuum tubes led to the use of very high speed vacuum switching devices in place of the electromechanical devices.
> These tubes consumed very high power and produced large amount of heat.

## ENIAC

$>$ ENIAC contained about 18,000 Vacuum tubes and about 6000 switches. This machine was about 5000 times faster than the IBM-MARK1.
$>$ But the there were many disadvantages of this machines like, the size of machine was very large while the memory was very small.
> This machine consumed very high power (in many kilowatts).
> Major disadvantage of this machine was that it produced a large amount of heat, due to this everyday one or more tubes burnt and the replacement of these tubes was very difficult.

## EDSAC

> In 1949, Professor Maurice Wilkes of Cambridge University, England developed a computer named EDSAC (Electronic Delay Storage Automatic Computer).
$>$ This machine was able to perform different mathematical calculations in microseconds.

## EDVAC

> Almost simultaneously with EDSAC, in 1952 Dr. John Von Neumann of the Pennsylvania University developed another computer named EDVAC (Electronic Discrete Variable Automatic Computer).
$>$ This was a refinement of ENIAC computer. This computer was based on a new concept of 'stored program' developed by Dr. Von Neumann.
$>$ Dr. Neumann also used first time storing and manipulating data and instructions in the binary form.
$>$ All modern digital computers (except super-computer) are designed based on Von Neumann computer.
IBM - 701
> In 1952, IBM Corp developed a computer IBM-701. This was an electronic computer. This computer used magnetic drum for data storage.
$>$ This consisted of a cylinder coated with a magnetic recording material. This device could access data hundreds of time faster than the punched cards.
$>$ But the major problem with these drums was that they could not be removed from the drive unit and capacity was very limited.

## UNIVAC

$>$ After the invention of ENIAC computer, developers of this computer Eckert and Mauchly left the Pennsylvania University and formed their own company.
> They developed a new computer and named it UNIVAC (Universal Automatic Computer).
$>$ This computer used magnetic tapes first time for input and output. This computer became very popular due to its smaller size and had very low cost than the earlier computers.
$>$ UNIVAC computer was widely used in business and commercial fields.

## b. Second Generation (1959-1965)

> With the advent of transistor technology, second generation of computers came into existence.
$>$ Transistors were usually made of silicon metal which is a semiconductor.
> Working of these transistors was similar to vacuum tubes, but these were smaller in size and generated less heat in comparison to vacuum tubes.
$>$ Second generation computers were more reliable and highly efficient. These were easy to transport due to its 'solid state'.
$>$ These computers used High Level Languages like BASIC etc. These languages are English like languages which are easy to programme and understand.
> Second generation computers used magnetic tapes or magnetic drum for secondary storage purposes.

## c. Third Generation (1965-1970)

> J.S. Kilivi of Texas Instrument Co. introduced a new technology in 1958, which made possible to combine hundreds or even thousands of transistors, diodes and other components in a small single chip.
> This chip is known as Integrated Circuit (IC) chips, which is a solid state micro-electronic technology.
> Third generation computers were based on these IC chips. These computers were very low in cost and the speed was thousands of time faster than the first generation computers.
> Third generation computers made possible the multi programming and multiprocessing concepts. These computers used improved input / output and backing storage devices.
> Third generation computers became very popular in many colleges, universities, laboratories etc.

## d. Fourth Generation (1970-1995)

$>$ IC chips which were used in third generation computers contained hundreds or even thousands of transistors and other components on a single chip.
> These chips were also known as Small Scale Integration (SSI) and Medium Scale Integration (MSI).
$>$ This was the 'microprocessor', which was used first time in this generation's computers.
$>$ The first microprocessor chip was developed by Intel Corp. of USA.
$>$ The invention of microprocessor chip made a revolution in the computer industry.
$>$ Fourth generation computers are much faster and cheaper than the second generation computers.
> These computers have greater data processing capacity and can process data at the speed of about hundreds or millions of instructions per second.
$>$ These computers can be connected with communication lines to form a communication link from one part to the other part of the world.
$>$ Some fourth generation computer manufactures are IBM, Hewlett - Packard, Apple etc.

## e. Fifth Generation (1995 onwards)

$>$ Fifth generation computers are expected to have capabilities like recognition of voice, response of voice.
$>$ These computers will be able to learn and think. For these types of ability a new technique, Artificial Intelligence has been developed.
$>$ Voice recognition is a technique in which a computer will be able to recognize the human voice.
$>$ In this type of system, computer consists of a microphone which recognizes the user's word, translates it into digital form, then this translated signal is analyzed with a dictionary of patterns stored in the computers' memory.
$>$ Recognized words are matched step-by-step and when a match is found then corresponding word is used by the computer.
$>$ Voice response is a technique in which a computer will be able to talk with the user.
$>$ In this system input data is processed and output is converted to appropriate sound.
> These computers will be very small in size and will have the tremendous data processing speed and storage capacity.
> This fifth generation computer will use different and much improved memory devices such as bubble memory and optical disk.

## Classification by Principle

Based on their working and electronics computers can be classified into three categories.
> Analog Computer
$>$ Digital Computer
> Hybrid Computer

## Analog Computer

> Analog Computer operates at continuous voltage or current.
$>$ This name is derived from the Greek word 'Analog' which means to find out similarity between two quantities.
$>$ These computers have to be constructed to perform only specific task.
> An example of this is the constant monitoring of the Electro Cardiogram of a patient.
$>$ Analog computers are less accurate than the digital computers. Accuracy of these computers can be up to 99 percent.

## Digital Computer

$>$ Digital computer operates on electronic inputs that have only two states ON and OFF (i.e. binary ONEs and ZEROs).
$>$ The word computer is generally used for these binary digital computers.
$>$ Digital computers are useful for evaluating arithmetic expressions and manipulation of data.
> The accuracy and speed of digital computers are cheaper and smaller in size in comparison to analog computers.
> Digital computers are the most popular computers all over the world these days.

## Hybrid Computer

$>$ In some applications both digital and analog features are used to solve problems.
$>$ So a new type of computer is developed which is partly digital and partly analog that means a computer which has the property of both computers.
$>$ Such computers are called Hybrid computers. Hybrid computers are not widely used.

## Classification by Size

In this classification, computers are classified according to size not the physical, size in terms of speed, capacity and other functions. Computers can be divided as follows -
$>$ Microcomputers
$>$ Minicomputers
> Mainframes
> Supercomputers

## a. Microcomputers

$>$ The electronic revolution introduced microcomputers. These are smaller in size, type of size, speed and capacity amongst all types of computers.
> Microcomputers have all the functional elements found in a large computer. These are usually designed to be used by one person at a time.
$>$ Microcomputers usually have a 8 bit or 16 bit or 32 bit microprocessor and have two types of memory - RAM (Random Access Memory) and ROM (Read Only Memory).
> 16 bit Microprocessor
> 32 bit Microprocessor

## b. Minicomputers

Minicomputers are larger computers in comparison to microcomputers.
> Microcomputers support only one user at a time whereas minicomputers can support more than one user at a time.
$>$ These computers have larger memory, speed and data storage capacity than the micros.
> The speed and memory of those mini computers were much smaller than today's micro computers, but those machines were very popular in 1960s and 70s.
> These days' microcomputers are widely used by medium size organizations, Research and Development Organizations.

## c. Mainframes

Mainframe computers are very large computers and have a great storage capacity and processing speeds.
> Mainframes use several microprocessors in place of single microprocessor used in micros or in minis.
> These computers can be linked into a network with many micros. Mainframes support many hundreds user.
> These are mainly used for commercial applications and by government departments such as railway and airline reservation system.

## d. Super Computers

$>$ Super computers are the most powerful amongst all the computers. All the computers are based on Von-Neumann design but the super computers use Non - Von Neumann design.
$>$ Super computers contain many processors and use parallel processing. These computers use more advanced devices for memory like bubble memory and can process billions of instructions per second.
$>$ Super computers are used for complex scientific applications such as weather forecasting, satellite communications.
$>$ First super computer was developed by Cray Research and Control Data Corp. of United States.
$>$ Flow Solver developed by National Aerospace Laboratory of India and PARAM developed by Centre for Development and Advanced Computing (C-DAC) under the Department of Electronics, India.

## Benefits / Characteristics of Computer

Computer has affected the human life very much, because it can do a variety of tasks easily, which human being cannot do easily. These days computer has entered in all parts of human life. Few of these capabilities of computer are enough to show the importance of computers.

## Speed

$>$ Speed of computer is one of the important characteristics. It can do calculations in micro or even in nanoseconds.
$>$ Modern computers are able to process millions or even billions of instructions in a second.
$>$ We can imagine the high speed of computer from this fact - while the human brain can take 40,000 instructions per second, computer may take up to 140,000 million instructions per second.
$\rightarrow$ Also human brain transmits binary pulses (signals) ten billion times slower than a micro computer.

## Accuracy

$>$ Computers does not lose the accuracy even if they work at very high speed, if a person increases the speed, chances of errors also increase.
$>$ This is the major difference between human brain and computers. Due to this characteristics human can depend on computers.

While the computers are highly accurate machines, these machines, can also give errors. But these errors mainly depend on user, not on the machines. Also these machines can do repetitive tasks without any error as many times.

## Data storage

$>$ Storage capacity of computer is very high. It can store large amount of data in a very little space.
> It uses many devices to store the data such as - floppy disks, hard disks, optical disks, magnetic tapes etc.
$>$ We can just imagine the storage capacity of computer from this fact that one optical disk can store many encyclopedias in it.
$>$ Today's research is mainly concentrated on speed and storage capacity.

## Power of Remembering

$>$ Power of remembering of the computer is hundred per cent.
$>$ A man can forget the information as the time passes but the computer retains the information several years without losing the quality of information or data.
> Unlike man every piece of information can be recalled as and when required. A computer forgets or loses certain information only when it is asked to do so.
$>$ So, it is entirely up to the user to make a computer retain or forget particular information.

## Activeness

$>$ Unlike human beings, computers do not feel tiredness and carelessness.
$>$ After a long period of continuous work human loses its concentration and decreases the efficiency, but the computers are free from these types of problems.
$>$ Versatility
> Computer's enormous speed, memory and accuracy have made it the most popular machine.
$>$ Another reason of its popularity is that computer can do a variety of jobs well.
$>$ Computers help in automation of many industrial and business systems.
> These care extensively used in manufacturing and process control, airline and railway reservation system, in banking, weather forecasting and also in sending mails.
$>$ Today space technology completely depends on computers.
$>$ To make use of computer man has reached the moon and is trying to reach other planets.
> We can imagine the role of computers in space technology from this incident in U.S.A., just before the final countdown, space shuttle Columbia was abruptly stopped for sometime.
> The reason was difference by a few milliseconds noticed between the computers aboard the space craft and the ones at the mission control of Houston.
$>$ These are some of the fields which are making full use of computers. Computers are also playing an important role in many other fields.

## COMPUTER ARCHITECTURE

## Central Processing Unit (CPU)

Central Processing Unit is the heart of the computer system and usually called as CPU. Central Processing Unit (CPU) has three parts. These are:

## > Main Memory

$>$ Arithmetic and Logic Unit
> Control Unit

## A Digital Computer



## Main Memory

> Main memory is also known as Immediate Access Storage or Primary Storage.
> Main memory is used to store data and instructions temporarily. Final results are also stored in main memory before the permanent storage.
$>$ Computers use different types of memories. These are:
$>$ RAM, ROM, Cache memory.

## RAM (Random Access Memory)

$>$ This is the abbreviated form of the Random Access Memory.
$>$ RAM holds programs and data while the computer works.
$>$ This is a volatile memory that means data and information retains in it only as long as the computer runs.

## ROM (Read Only Memory)

$>$ ROM is the abbreviated form of Read Only Memory.
$>$ This is a special kind of memory and is different from Random Access Memory.
$>$ This is a permanent memory and does not lose data when computer is turned off.

## PROM (Programmable Read Only Memory)

$>$ PROM stands for Programmable Read Only Memory.
$>$ ROM chips and PROM chips are very similar, both are Read Only Memories, and both are used to store some essential programs.
$>$ Difference between both the chips is that ROM chips are programmed at the time of manufacturing, whereas PROM chips are supplied without any programme.

## EPROM (Erasable Programmable Read Only Memory)

$>$ EPROM is the abbreviated form of Erasable Programmable Read Only Memory.
> Programmers stored in ROM or PROM chips cannot be changed.
$>$ EPROM chips allow the programmer to erase and reprogramme. This is done by ultraviolet rays.

## EEPROM (Electrically Erasable, Programmable Read Only Memory)

> This memory stands for Electrically Erasable, Programmable Read Only Memory.
$>$ These type of memory chips are erased and reprogrammed by special electrical circuits in place of ultra-violet rays.

## Cache Memory

> Speed of microprocessor in comparison to main memory is very high, so it decreases the performance of microprocessor.
$>$ To make use of the full performance of microprocessor, a small memory between CPU and main memory whose access time is close to the processing speed of CPU is used these days.
$>$ This memory is called 'cache memory'. This memory is expensive than the main memory.

## Arithmetic and Logic Unit

> Arithmetic and Logic Unit is usually known as ALU.

This is the unit where all the mathematical calculations (i.e. addition, subtraction, multiplication and division) and logical comparisons (i.e. less than, greater than etc.) are made.
$>$ Data stored in main memory is transferred to ALU. Finally processed data and then information is released to output unit.

## Control Unit

$>$ Control Unit (CU) controls the entire operations of Arithmetic and Logic Unit.
$>$ Control Unit picks up the data and instruction from main memory and transfers to ALU one by one. ALU responds to these instructions.
$>$ After processed by ALU, Control Unit transfers the information from ALU to main memory and finally on to output unit.

## Input Devices

$>$ An input device is any machine that feeds data into a computer.
$>$ For example, a keyboard is an input device, whereas a display monitor is an output device.
> Input devices other than the keyboard are sometimes called alternate input devices.
> Mice, trackballs, and light pens are all alternate input devices.
> Keyboard
$>$ Keyboard is the most popular input device. Sometimes it is also called as keypad.
$>$ Keyboard is similar to a type writer's keyboard, except that it contains some additional keys.
> Operations of computer keyboards' keys are much softer than the type writer's keys.
$>$ Earlier keyboards consist of 84 keys, whereas today's keyboards contain 101 keys. These keyboards are pronounced as 'one-zero-one' keyboard.
$>$ Computer keyboard can be divided into three sections:
> Alphanumeric keys
$>$ Function keys
> Special keys
Alphanumeric keys are similar to typewriter's keys and cover most of the space.
$>$ Alphanumeric keys contain digits (0-9), Alphabets in uppercases (A-Z) and some other characters like $\sim,!, @, \#, \$, \%$, a etc. and many more.
$>$ Function keys are used to perform a specific task through a single keystroke.
> For example, usually all the software use F1 function key for getting help at any time.
$>$ Function keys are not available in type-writers. These keys are twelve (named F1 to F12).
> These functions keys are located on the upper first row in some keyboards or on the left side in two rows in some others.

Special keys also perform some specific task such as when CAPS Lock key is ON all the letters typed through keyboard are converted into upper case letters.
$>$ DEL key deletes one character or file or folder. BACKSPACE key deletes one character left from the cursor.
> Keyboard contains many other and special keys for different purpose. Some other keys are - NUM LOCK Key, TAB key, CTRL key, ALT key, SHIFT key etc.
$>$ In most of the keyboards some special keys are duplicate (e.g. Alt, Shift and Ctrl keys). These are only to speed up the typing speed.

## Magnetic Ink Character Reader (MICR)

> Magnetic Ink Character Reader (MICR) is a device which is widely used by banks to process cheques.
$>$ It can process hundreds of cheques in a minute.
$>$ Cheque number, branch number and some other important information are printed on the cheque.
> This information is printed with a special Ink which contains magnetisable particles of iron oxide.
$>$ When the cheque is presented in bank by customer, MICR detects the characters and compares the scanned characters with standard characters.
$>$ If a match is found then characters are sent for further processing.
$>$ The advantages of MICR are that it speeds up the processing and roughly handled, or folded cheques can be easily read with the same accuracy.
> MICR can read about 3000 cheques per hour.

## Optical Mark Reader (OMR)

$>$ Optical Mark Reader (OMR) is an input device. OMR is used to detect the present or absence of mark.
$>$ OMR scans the mark with a photoelectric device.
$>$ Light is focused onto the mark then the reflection of light is sensed by OMR. If a mark is there then lesser light is reflected.
$>$ This reflected light pattern is then compared with the stored mark.
$>$ If a close match is found the mark is recognized. OMR is widely used in examinations.
> Questionnaires are designed in a special manner such that questions are asked with a choice of multiple answers and mark put at correct answers.
> These marks must be clear and should match with the mark as mentioned in questionnaires.
> Marks put by led pencil are best suited for sensing. The advantage of OMR is that it reduces chances of human errors.

## Optical Character Reader (OCR)

Optical Character Reader works in a similar fashion and can recognize the characters.
$>$ OCR contains all the characters in place of marks.
$>$ OCR devices are also widely used in examinations.

## Light Pen

$>$ A light pen is an input device which is used for graphic purpose.
> Light pen is also known as "Electronic Pen".
$>$ This is used to draw lines and curves which is not easy through keyboard.
$>$ Light pen looks like an ordinary pen and consists a stylus which is connected through a cable to the video display terminal.
$>$ When the user puts this photo sensitive device on the Cathode Ray Tube (CRT) a dot appears on the screen.

## Mouse

$>$ Mouse is also an input device.
> Mouse is a small device which contains a tracking ball in its bottom and two or three buttons on the upper side.
> This can be put on any plain surface. When the user rolls the mouse across the surface, tracking ball at the bottom also moves and causes the movement of cursor on the screen.
$>$ After positioning the cursor on the screen a click of mouse's button points that position or selects the required option from menu.
> Some software also allows drawing lines and curves on the screen with the help of mouse.
> Since it is very easy to control the cursor through mouse so the popularity of mouse is increasing day by day.

## Types of Mice

$>$ There are three basic types of mice.
> Mechanical: Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.
$>$ Opto Mechanical: Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.
> Optical: Uses a laser to detect the mouse's movement. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical and optomechanical mice, but they are also more expensive.

## Joystick

$>$ A lever that moves in all directions and controls the movement of a pointer or some other display symbols.
$>$ A joystick is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse.
$>$ With a joystick, the pointer continues moving in the direction the joystick is pointing.
$>$ To stop the pointer, you must return the joystick to its upright position.
> Most joysticks include two buttons called triggers.

## Scanners

> Scanner is an input device that can read text or illustrations printed on paper and translate the information into a form that the computer can use.
> A scanner works by digitizing an image - dividing it into a grid of boxes and representing each box with either a zero or a one.
> Optical scanners do not distinguish text from illustrations; they represent all images as bit maps.
> Therefore, you cannot directly edit text that has been scanned.
> To edit text read by an optical scanner, you need to have an Optical Character Recognition (OCR) system to translate the image into ASCII characters.
> Most optical scanners sold today come with OCR packages.

## Digital Camera

Images can be input into a computer using digital camera.
$>$ These images can then be manipulated in many ways using the various imaging tools available.
> The digital camera takes a still photograph, stores it, and then sends it as digital input into the computer.
$>$ The images are then stored as digital files.

## Touch Screen

Touch screen is a type of display screen that has touch sensitive transparent panel covering the screen.
> Instead of using a pointing device such as a mouse or light pen, you can use your finger to point directly to objects on the screen.

## Output Devices

$>$ Output is anything that comes out of computer.
$>$ Output can be meaningful information or and it can appear in variety of forms - as binary numbers as characters, as pictures, and as printed pages.
$>$ An output device is any machine capable of representing information from a computer.
$>$ Output devices include display screens, loud speakers, printers, plotters etc.

## Monitor (Visual Display Unit)

> Monitor is another term for the display screen.
> The term monitor, however, usually refers to the entire box, whereas display screen can mean just the screen.
> Types of Monitor

- Digital Monitor
- Analog Monitor


## Printers

$>$ Printer is a device that prints text or illustrations on paper in many cases on transparencies and other media.
$>$ There are many different types of printers. In terms of the technology utilized, printers fall into the following categories.
> Dot-Matrix Printer: Dot-Matrix printers create characters by striking pins against an ink ribbon. Each pin makes a dot, and combinations of dots form characters and illustrations.
$>$ Dot-Matrix printers are inexpensive and relatively fast, but they do not produce high-quality output.
> Ink-Jet Printer: Ink-Jet printers work by spraying ionized ink at a sheet of paper.
$>$ Ink-jet printers are capable of producing high quality print. A typical ink-jet printer provides a resolution of 300 dots per inch (dpi).
$>$ Although some newer models offer higher resolutions ( 600 dpi ).
$>$ Laser Printer: laser printer utilizes a laser beam to produce an image on a drum.
> The light of the laser alters the electrical charge on the drum whenever it hits.
$>$ The drum is then rolled through a reservoir of tonner, which is picked up by the charged portions of the drum.
$>$ Finally, the toner is transferred to the paper through a combination of heat and pressure.
$>$ This is also the way copy machines work.

## Plotters

> Plotters are also used for hard copy outputs, but are used for complex tool designs, architectural designs and other types of technical diagrams.
> Plotters are highly accurate devices.
$>$ Plotters differ from printers in that they draw lines using a pen.
$>$ As a result, they can produce continuous lines, whereas printers can only simulate lines by printing a closely spaced series of dots.
$>$ Multicolor plotters use different-coloured pens to draw different colours.
$>$ In general, plotters are considerable more expensive than printers.
$>$ They are used in engineering applications where precision is mandatory.

## Sound Cards and Speakers

$>$ An expansion board that enables a computer to manipulate and output sounds.
> Sound cards are necessary for nearly all CD-ROMs and have become commonplace on modern personal computers.
$>$ Sound cards enable the computer to output sound through speakers connected to the board, to record sound input from a microphone connected to the computer, and manipulate sound stored on a disk.

## Internal and External Storage Devices

$>$ From the invention of computer till now backing storage (secondary storage devices) capacity is one of the major research areas for computer enthusiasts.
> Today's backing storage devices have enormous capacity than the earlier devices, but the increasing need of data and information has indicated, there is still a requirement to improve the capacity.
> Backing storage devices are also known as Secondary storage devices or Auxiliary storage devices.
$>$ These devices are used to store data permanently. A good backing storage device should have:
$>$ High retrieval speed
> High storage capacity
> Low cost
> Punched Cards and Paper Tapes
$>$ These are the oldest storage devices.
> Punched cards were invented in the $18^{\text {th }}$ century, but before 1920 there was no standard. IBM corp. standardized the punched cards.
$>$ These standard punched cards are of $19 \mathrm{~cm} . * 8.3 \mathrm{~cm}$. These punched cards were made of cardboard which had the thickness of 0.17 mm .

- A punched card is divided into 80 vertical columns and 12 horizontal rows.
$>$ First ten rows from the bottom are used to represent the digits, and alphabets are represented by the punching in $11^{\text {th }}$ and $12^{\text {th }}$ rows.
$>$ Hence, one punched card can store maximum 80 characters.
> These cards are punched by a special punching machine called 'Card Punching Machine'.
> Magnetic Tape
> Magnetic tape is magnetically coated strip of plastic on which data can be encoded.
$>$ Tapes for computers are similar to the tapes used to store music.
> Some personal computers, in fact, enable you to use normal cassette tapes.
> Storing data on tapes is considerably cheaper than storing data on disks.
> Tapes also have large storage capacities, ranging from a few hundred kilobytes to several gigabytes.
$>$ Accessing data on tapes, however, is much slower than accessing data on disks.
> Tapes are sequential access media, which means that to get to a particular point on the tape, the tape must go through all the preceding points.
$>$ In contrast, a disk drive can access any point at random without passing through intervening points.
$>$ Because tapes are so slow, they are generally used only for long term storage and backup.
$>$ Data to be used regularly is almost always kept on a disk. Tapes are also used for transporting large amounts of data.


## Floppy Disk

> Floppy disk is a soft magnetic disk. It is called floppy because it flops if you wave it (at least, the $5{ }^{1 / 4}$ inch variety does).
> Unlike, most hard disks, floppy disks (often called floppies or diskettes) are portable, because you can remove them from a disk drive.
$>$ Disk drives for floppy disks are called floppy drives.
> Floppy disks are slower to access than hard disks and have less storage capacity, but they are less expensive and are portable.
$>$ Floppies come in two basic sizes:
$>5^{1 / 4}$ inch: The common size for PCs made before 1987. This type of floppy is generally capable of storing between 100 KB and 1.2 MB of data.
> $3^{1 / 2}$ Floppy: Despite their small size, microfloppies have a larger storage capacity than their cousins.

## Hard Disk

$>$ Hard disk is a magnetic disk on which you can store computer data.
$>$ The term hard is used to distinguish it from a soft, or floppy, disk.
$>$ Hard disks hold more data and are faster than floppy disks.
> A hard disk, for example, can store anywhere from 10 megabytes to several gigabytes, whereas most floppies have a maximum storage capacity of 1.4 megabytes.

## Optical Disk

> Optical Disks are a storage medium from which data is read and to which it is written by lasers.
> Optical disks can store much more data - up to 6 gigabytes ( 6 billion bytes) - than magnetic media, such as floppies and hard disks.
$>$ There are three basic types of optical disks;
$>$ CD-ROM: In CDs or CD-ROM the data is permanent and can be read any number of times, but CD-ROMs cannot be modified / altered.
> WORM: This term stands for write-once, read many. With a WORM disk drive, you can write data onto a WORK disk, but only once. After that, the WORM disk behaves just like a CD-ROM.
$>$ Erasable: Optical disks that can be erased and loaded with new data, just like magnetic disks. These are often referred to as EO (erasable optical) disks.
> Magneto - Optical (MO) Drives
> This is a type of disk drive that combines magnetic disk technologies with CD-ROM technologies.
$>$ Like magnetic disks, MO disks can be read and written to.
> And like floppy disks, they are also removable.
$>$ However, their storage capacity can be more than 200 megabytes, much greater than magnetic floppies.
$>$ In terms of data access speed, they are faster than magnetic floppies.
> In terms of data access speed, they are faster than floppies and CD-ROMs, but not as fast as hard disk drives.
$>$ Other backing storage devices (secondary storage or auxiliary storage devices) are JazDisk developed by the Iomega Corporation, Super Disk was developed by the Imation Corporation.

## DIGITAL INITIATIVES IN HIGHER EDUCATION

$>$ The quality and access to higher education has been a subject of intense concern to all of us. The advancements in digital technologies are transforming the way educational resources are being created, disseminated and accessed across the world.
> Use of digital technologies in all aspects of higher education has also received a major push in India. This in turn helps the quality improvement \& accessibility of Higher Education to large part of students as well as up-skilling of the teachers across the country
$>$ Digital technologies have also greatly impacted the management and governance of the institutions as well as the accreditation and ranking of the Higher Education Institutions (HEIs).
> Department of Higher Education, Ministry of Human Resource Development, has undertaken many initiatives for exploiting the digital technologies in improving the quality \& accessibility in Higher Education as well as better tools for accreditation and grading of educational institutions
$>$ The use of Information and Communication technology (ICT) has great potential in improving the quality of education imparted and widening the access of education throughout the country.

For this purpose, the Department of Higher Education, Ministry of Human Resource Development (MHRD) has undertaken many initiatives under 'National Mission on Education through Information and Communication Technology'
> Important Factors for the Use of ICT In HE's


## NATIONAL MISSION ON EDUCATION THROUGH ICT (NMEICT)

$>$ To improve the learning outcomes and improve the access and quality of learning, Technology offers solutions, in the form of digital education. National Mission on Education through ICT (NMEICT) is a major initiative of Ministry of Human Resource Development (MHRD) to infuse digital education solutions to improve the access to quality contents and also to improve the learning outcomes.
$>$ Even though various initiatives have been taken up under NMEICT programme, the major currently ongoing initiatives like SWAYAM, SWAYAM Prabha, National Digital Library (NDL), e-Yantra, FOSSE, Spoken Tutorials, and Virtual Labs are being implemented by various higher educational institutions.

## SWAYAM www.swayam.gov.in

> The 'Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM) is India's own MOOCs platform offering free online courses on almost all the disciplines. A programme initiated by Government of India, designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality has the objective to ensure access to the best teaching learning resources to all, including the most disadvantaged
> SWAYAM was formally launched on 09.07 .2017 by the Hon'ble President of India. Shree Ramnath Kovind. Till date, about 2200 Courses have been offered through SWAYAM in
which about 500 courses are on offer for January 2019 semester. More than 50 Lakhs students have registered on SWAYAM platform and there are more than 1 crore enrollments in various courses.

## SWAYAM PRABHA www.swayamprabha.gov.in

$>$ SWAYAM PRABHA is an initiative to provide 32 high quality educational channels through DTH (Direct to Home) across the length and breadth of the country on 24X7 basis. This would enable to deliver e-education in a most cost effective $\&$ inclusive manner.
$>$ The Department of Space has allotted two GSAT-15 transponders for the same. Hon'ble President of India has launched the SWAYAM Prabha on 9th July, 2017. The subscribers of free DTH service of Doordarshan (Free dish) and Dish TV (Zee) would be able to view these Educational channels using the same Set Top Box and TV
$>$ The contents are prepared by different MHRD agencies like CEC, IGNOU, IITs, NIOS and NCERT

## NATIONAL DIGITAL LIBRARY (NDL) www.ndl.gov.in

$>$ The National Digital Library of India (NDL) project has been entrusted to IIT Kharagpur to develop the overall framework of a facility that can provide a single window access to learners for e-contents/resources.
$>$ The vision is to build NDL as a National Knowledge Asset that should become the key driving force for education, research innovation and technology economy in India.
> NDL is available at https://www. ndl.gov.in. It is also available as Mobile App (Android and iOS) and on UMANG Platform. Anybody can register in NDL at no cost. Currently, NDL has about 200 lakh of content items and about 45 lakh of registered users.
$>$ NDL integrates the existing digitized and digital contents across educational and cultural institutions / bodies, publishers, etc. to provide a single window access to different groups of users ranging across the entire population

## e-YANTRA www.e-yantra.org

$>$ e-Yantra is a project entrusted to IIT Bombay for enabling effective education across engineering colleges in India on embedded systems and Robotics. The training for teachers and students is imparted through workshops where participants are taught basics of embedded systems and programming.

## VIRTUAL LAB www.vlab.co.in

$>$ This initiative provides remote access to Labs in various disciplines of Science and Engineering. Students can also strengthen their concepts by performing Virtual labs experiments at a place and time of their choice, outside lab hours. These Virtual Labs
would cater to the students at the undergraduate level, postgraduate level as well as to research scholars.
> There are 12- participating institutes; IIT Delhi, IIT Bombay, IIT Madras, IIT Guwahati, IIT Kharagpur, IIT Kanpur, IIT Roorkee, NITK Surathkal, COE Pune, Amrita Vishwa Vidyapeetham, and Dayalbagh Educational Institute Agra. IIT Delhi is the Coordinating Institute

## FOSSEE www.fossee.in

$>$ The FOSSEE (Free/Libre and Open Source Software in Education) Project, promotes the use of FLOSS (Free/Libre and Open Source Software) tools to improve the quality of education in our country. It aims to reduce the dependency on proprietary software in educational institutions. It is being implemented by IIT Bombay.

## SPOKEN TUTORIAL www.spoken-tutorial.org

This project helps everyone learn various Free/Libre and Open Source Software all by oneself. The selfpaced, multilingual courses ensure that anybody with a computer and a desire for learning, can learn from any place, at any time and in a language of their choice. Internet is not required to use Spoken Tutorials. This project is being implemented by IIT Bombay

## NATIONAL ACADEMIC DEPOSITORY www.nad.gov.in

$>$ National Academic Depository (NAD) is an online store house of academic awards (degrees, diplomas, certificates, mark sheets etc.) lodged by the academic institutions / school boards / eligibility assessment bodies in a digital format. NAD is on 24X7 online modes for making available academic awards and help in validating their authenticity, their safe storage and easy retrieval.
$>$ National Academic Depository comprises of two interoperable digital depositories viz. CDSL Ventures Limited (CVL) and NSDL Database Management Limited (NDML). The University Grants Commission (UGC) is the authorized implementing body of NAD. The details regarding NAD are available at www.nad.gov.in.

## PLAGIARISM DETECTION SOFTWARE

$>$ MHRD intends to provide plagiarism detection software to all the Universities to facilitate easy detection of plagiarized content in the academic and research works including articles in journals and conference proceedings, chapters in books, theses, research reports, assignments, project works, lecture notes, e-text / e-content for MOOCs and LMS, etc.

## ANNUAL REFRESHER PROGRAMME IN TEACHING (ARPIT)

$>$ The Ministry of Human Resource Development has officially launched Online Annual Refresher Programme in Teaching (ARPIT) on 13th November, 2018, a major and unique initiative of online professional development of 15 lakh higher education faculty using the MOOCs platform SWAYAM.
> For implementing ARPIT, 75 discipline specific National Resource Centres (NRCs) have been identified in the first phase, which are tasked to prepare online training material with focus on latest developments in the discipline, new $\&$ emerging trends, pedagogical improvements and methodologies for transacting revised curriculum

## E-SHODHSINDHU: CONSORTIUM FOR HIGHER EDUCATION ELECTRONIC RESOURCES

> The MHRD, Govt of India has formed e-ShodhSindhu merging three consortia initiatives, namely UGC-INFONET Digital Library Consortium, NLIST and INDEST-AICTE Consortium.The e-ShodhSindhu will continue to provide current as well as archival access to more than 10,000 core and peer-reviewed journals and a number of bibliographic, citation and factual databases in different disciplines from a large number of publishers and aggregators to its member institutions including centrally-funded technical institutions, universities and colleges that are covered under 12(B) and 2(f) Sections of the UGC Act.

## CAMPUS CONNECTIVITY

> The Ministry of Human Resource Development is planning a new programme called Campus Connect. Under these programme 21,000 colleges, 20 classrooms will be made Wi-Fi enabled. Totally, 4.2 lakh classrooms will be made Wi-Fi enabled and this will help around 1.5 crore students. Students will be given access only to those websites which are academically relevant.
$>$ All the buildings of 600 universities that have 1 Gbps bandwidth will be made by Wi-Fi enabled. This includes Government of India funded institutions, state government universities and also private universities. This will help around 20 lakh students. The whole campus of all the 140 centrally funded Institutions of Ministry of HRD will be made Wi-Fi enabled.
$>$ The National Mission on Education through Information and Communication Technology (NMEICT) aims to leverage the potential of Information and Communication Technology (ICT) in teaching and learning process. The Mission also aims to provide 20 Broadband connections of 512 Kbps speed to over 25,000 colleges and 2000 polytechnics and optical fiber connectivity one Gbps to 419 universities/ university level institutions in the country which includes internet facility.

## TALK TO TEACHER

$>$ The portal provides free access to a few selected graduate and postgraduates courses taught at IIT Bombay by distinguished faculty member and scholars.

## The objective is:

$>$ To reach out by sharing the expertise of distinguished IIT Bombay faculty members.
$>$ To provide quality engineering education for students and faculty of engineering institutions in the country.
> To help working professionals update their knowledge.
$>$ To create resources to further critical thinking and intellectual exploration.
$>$ These courses can be viewed absolutely free of charge at lower bandwidths on a personal computer/laptop having a headphone though internet connection. Registration is not required as we do not have any evaluation / certification process. The courses are recorded live in the classrooms of IIT Bombay and may not reflect entire content of the course.

## ASK A QUESTION:

$>$ IIT Bombay launches 'Ask a Question' portal, expert panel to resolve conceptual doubts of students via website


IIT Bombay Ask a Question Initiative: IIT Bombay has launched a unique initiative under the banner of 'Ask a Question'. As part of this initiative, the premier technology institute of India has launched a website, giving a digital platform to Engineering and Science students to raise their queries and doubts about scientific concepts. Following this, an expert panel consisting of IIT Bombay faculty members will answer the queries and thereby resolve the conceptual doubts and thought process of the students.

## E-ACHARYA

$>$ Is an integrated e-content portal developed under National Mission for Education through ICT (NME-ICT). The portal provides facility to search and browse the learners all learning materials includes audio, video, textual materials, etc. through a single interface. The portal cover quality learning resources from top institutions in the country in eight subject categories viz Agriculture Science, Biological Science, Chemical Science, Physical Science, Medical and Health Sciences, Engineering and Technology, Social Sciences, and Arts and Humanities.

## E-VIDWAN

VIDWAN is the premier database of profiles of scientists / researchers and other faculty members working at leading academic institutions and other $\mathrm{R} \& \mathrm{D}$ organisation involved in teaching and research in India. It provides important information about expert's background, contact address, experience, scholarly publications, skills and accomplishments, researcher identity, etc. The database developed and maintained by Information and Library Network Centre (INFLIBNET) with financial support from the National Mission on Education through ICT (NME-ICT). The database would be instrumental in selection of panels of experts for various committees, taskforce, established by the Ministries / Govt. establishments for monitoring and evaluation purposes.


## ICT AND E-GOVERNANCE

## Introduction:

The " E " in e- governance stands for electronic. Thus e- governance is basically associated with carrying out the functions and achieving the resuts of governance through the utilization of ICT ( Information and Communication Technology).

In this century where almost everything has been made electronic like e-commerce, eservice, e-learning etc. The Indian government is also trying to go with the wave to govern through ICT. E-governance needs the help of ICT services to achieve their objective anytime, anywhere. It eliminates the need of physical travel by citizens to various government $t$ get their work done.

The major objective of e-governance is to support and simplify the governance for all the government agnets and citizens and businesses. $\backslash$

E-governance also means e-democracy where all forms of communication between the electorate and the electoral happen electronically and digitally.

## OBJECTIVES

"To provide a SMARRT Government"
$>$ S- The use of ICT brings simplicity in governance
> M- It brings morality to governance
> A- It makes the Government accountable
$>$ R -Due to increased communication speeds, the Government becomes responsive
> R- Increased access to information make a responsible Government
> T- Government becomes transparent

## About ICT and Governance

The term e-governance focuses on the use of new ICT by governments as applied to the full range of government functions. Thus e-governance is the application of ICT for delivering govt services, exchange of information, communication, transaction, integration, various standalone systems and services between govt and citizens, govt and business as well as back office process and interaction within the entire govt frame work.

## Interactions in E-Governance

There are 4 kinds of interactions in e-governance, namely:

1. G2C (Government to Citizens) - Interaction between the government and the citizens.
$>$ This enables citizens to benefit from the efficient delivery of a large range of public services.
$>$ Expands the accessibility and availability of government services and also improves the quality of services
$>$ The primary aim is to make the government citizen-friendly.

## G2B (Government to Business):

> It enables the business community to interact with the government by using e-governance tools.
$>$ The objective is to cut red-tapism which will save time and reduce operational costs. This will also create a more transparent business environment when dealing with the government.
$>$ The G2B initiatives help in services such as licensing, procurement, permits and revenue collection.

## G2G (Government to Government)

$>$ Enables seamless interaction between various government entities.
$>$ This kind of interaction can be between various departments and agencies within government or between two governments like the union and state governments or between state governments.
> The primary aim is to increase efficiency, performance and output.
$>$ Read about government to government initiatives in the linked article.

## G2E (Government to Employees)

$>$ This kind of interaction is between the government and its employees.
$\rightarrow$ ICT tools help in making these interactions fast and efficient and thus increases the satisfaction levels of employees.

## Advantages of e-Governance

$>$ Improves delivery and efficiency of government services
$>$ Improved government interactions with business and industry
$\rightarrow$ Citizen empowerment through access to information
> More efficient government management
> Less corruption in the administration
> Increased transparency in administration
$>$ Greater convenience to citizens and businesses
$>$ Cost reductions and revenue growth
$>$ Increased legitimacy of government
> Flattens organisational structure (less hierarchic)
$>$ Reduces paperwork and red-tapism in the administrative process which results in better planning and coordination between different levels of government
> Improved relations between the public authorities and civil society
$>$ Re-structuring of administrative processes

## DIGITAL INDIA

> Digital India is a programme to transform India into digital empowered society and knowledge economy.
$>$ Transformational in nature and would ensure that Government services are available to citizens electronically.

## Vision Areas

$>$ The vision is centered on three key areas
> Digital infrastructure as Utility to Every Citizen
$>$ Governance and services on demand
> Digital empowerment of citizens

## Scope of Digital India

$>$ To prepare India for a knowledge future.
$>$ On being transformative that is to realize IT (Indian Talent) + IT (Information Technology) = IT (India Tomorrow).
> Making technology central to enabling change.
> On being an Umbrella Programme - covering many departments.

## Nine Pillars of Digital India

> Digital India aims to provide the much needed thrust to the nine pillars of growth areas, namely
$>$ Broadband Highways
> Universal Access to Mobile Connectivity
> Public Internet Access Programme
> e-Governance: Reforming Government through Technology
> e-Kranti - Electronic Delivery of Services
> Information for All
> Electronics Manufacturing
$>$ IT for Jobs
> Early Harvest Programmes

## E-Governance: Major Challenges in India

> The various barriers can be enumerated as follows:
> Poverty: Accessing Internet is a costly affair for the poor who struggle for their livelihood in developing countries like India. Required infrastructure in the form of installing the necessary telephone lines needed for internet or email access is equally unaffordable in most poor countries. u

## > Technical Illiteracy:

> Language Dominance: The dominance of English on the internet constrains the access of non-English speaking population. In the case of India, huge percent of the population does not speak English. Due to such overwhelming dominance of English over these communication channels, computers and the internet are quite useless in Indian villages
> Unawareness: There is general lack of awareness regarding the ICT.
> Infrastructure: Lack of necessary infrastructure like electricity, internet, technology and ways of communications will affect the speed which delays the implementation.
> Staffing and skills: covers the number of staff involved with the e- government system, and the competencies of those staff and other users

## Suggestions to overcome challenges

1. Improvement of Literacy rate
2. ICT growth
3. Proper implementation of projects
4. Need to have user friendly websites
5. Need to control population growth
6. Need to create Awareness among public about e- governance etc.

## LIST of Important ICT Computer Acronyms for UGC NET Paper 1

The UGC NET Paper 1 is the important part of the exam and the common ICT Abbreviations from the Computer Basic and Terminology is generally asked in this section.

BIOS - The Basic Input and Output System that controls the computer, it tells us about the operations to be performed on the System. The Instructions are embedded on a chip connected to the Motherboard

BYTE - Byte is known as the Storage unit of data
CPU - CPU is the Brain of a Computer. It is also known as the Central Processing Unit of the Computer.

MAC - The common abbreviation used for a type of personal Computer Macintosh made by the Apple Computer Company

OS - OS is the Operating System of the Computer. It is the main program that runs on the Computer and begins automatically when the Computer is turned on

PC - The Personal Computer is given the common abbreviation named PC. All the Computers are IBM Compatible

PDF - When the File is to be stored in the Portable Document Format, the term PDF is used.
RAM - The Space that can be accessed only one time is known as Random Access Memory. The Working Speed of the Computer System depends on the RAM.

ROM - The Instructions for the Computer is the ROM or Read Only Memory. ROM is a nonvolatile and cannot be altered

VGA - The System that is used for displaying the graphics is known as Video Graphics Array or VGA. It was developed by IBM

WYSIWYG - It is commonly Known as WIZZIWIG that means What You See Is What You Get. The basic meaning of this abbreviation is Printer will print what you see on your monitor.

## List of Common Computer Abbreviations in ICT UGC NET Paper 1

Check out the list of important common computer abbreviations of ICT asked in UGC NET Paper 1.

| S.No. | Abbreviation | Full Form of ICT Abbreviation |
| :---: | :--- | :--- |
| 1. | AGP | Accelerated Graphic Port |
| 2. | PC | Personal Computer |
| 3 | EPROM | Erasable Programmable Read Only Memory |
| 4. | BIOS | Basic Input and Output System |
| 5. | HDD | Hard Disk Drive |
| 6. | PCI | Peripheral Component Interconnect |
| 7. | UNIVAC | Universal Automatic Computer |
| 8. | GUI | Graphic User Interface |
| 9. | USB | Universal Serial Board |
| 10. | VGA | Visual Graphic Adaptor |
| 11. | MAN | Metropolitan Area Network |
| 12. | ASCII | American Standard Code for Information Interchange |
| 13. | WAN | Wide Area Network |
| 14. | EBCDIC | Extended Binary Coded Decimal Interchange Code |
| 15. | LAN | Local Area Network |
| 16. | EEPROM/ | Electrical Erasable /Alterable Programmable Read Only |
|  | EAPROM | Memory |
| 17. | CPU | Central Processing Unit |
| 18. | OS | Operating System |
| 19. | ALU | Arithmetic and Logical Unit |
| 20. | DVD | Digital Versatile Disc |
| 21. | CD | Compact Disk |
| 22. | ROM | Read Only Memory |
| 23. | VDU | Visual Display Unit |
| 24. | RAM | Random Access Memory |
| 25. | ICT | Information Communication Technology |
| 26. | PROM | Programmable Read Only Memory |
| 27. | URL | Universal Resource Locator |
|  |  |  |
|  |  |  |


| 28. | IDE | Integrated Drive Electronics |
| :--- | :--- | :--- |
| 29. | FORTRAN | Formula Translator |
| 30. | MOS | Metaoxide Semi-Conductor |
| 31. | ATX | Advanced Technology Extended |
| 32. | SIM | Subscriber Identification Module |
| 33. | MHZ | Megahertz |
| 34. | ISP | Internet Service Provider |
| 35. | GHZ | Gigahertz |
| 36. | DBMS | Database Management System |
| 37. | SQL | Structured Query Language |
| 38. | RW | Re Writeable |
| 39. | SDT | Serial Query Language |
| 40. | CAN | Campus Area Network |
| 41. | SIMMs | Single In line Memory Module |
| 42. | PAN | Personal Area Network |
| 43. | DIMMS | Dual In line Memory Module |
| 44. | CMOS | Complimentary Metaoxide Semi-Conductor |
| 45. | ENIAC | Electronic Number Integrator and Calculator |
| 46. | CMD | Command |
| 47. | EDSAC | Electronic Dialog Storage Automatic Computer |
| 48. | MAC | Media Access Control |
| 49. | IC | Integrated Circuit |
| 50. | LSIC | Large Scale Integrated Circuit |
| 51. | DIR | Directory |
| 52. | GIGO | Garbage In Garbage Out |
| 53. | PHP | PHP Hypertext Preprocessor |
| 54. | DOC | Document |
| 55. | PDT | Parallel Data Transmission |
| 56. | PDA | Personal Digital Assistant |


| 57. | USSD | Unstructured Supplementary Service Data |
| :--- | :--- | :--- |
| 58. | WWW | World Wide Web |
| 59. | COBOL | Common Basic Oriented Language |
| 60. | CCNP | Cisco Certified Network Professionals |
| 61. | BASIC | Beginner All Purpose Symbolic Instruction Code |
| 62. | CEH | Certified Ethical Hacking |
| 63. | TCP | Transmission Control Protocol |
| 64. | CSS | Cascading Style Sheet |
| 65. | CISCO | Computer Information System Company |
| 66. | XXS | Cross Site Scripting |
| 67. | XML | Extensible Markup Language |
| 68. | HTML | Hyper text Markup Language |
| 69. | CCNA | Cisco Certified Network Associate |
| 70. | RFI | Remote File Inclusion |
| 71. | HTTP | Hypertext Markup Language |
| 72. | DDOS | Distribution Denial of Service |
| 73. | VPN | Virtual Private Network |
| 74. | SEO | Search Engine Optimization |
| 75. | IP | Internet Protocol |

## LIST of Important Internet Network Based Abbreviations in ICT UGC NET Paper 1

Get the list of important abbreviations based on internet network which are generally asked in this section of UGC NET Paper 1.

FTP - File Transport Protocol is also known as FTP that moves a file between computers using the Internet Service

HTML - The Information is Formatted by the Hyper Text Markup Language, so it can be transferred to the Internet.

HTTP - Hypertext Transfer Protocol or HTTP is the set of instructions for the software that is used to control the movements of Files on the Internet

IP - The IP also known as Internet Protocol is the method of exchanging the data or information between the set of Computers on the Single Network or the series of the Interconnected Network.

ISP - Internet Service Provider is the Organization that provides the Internet Service to connect the device to the Internet Services.

LAN - The Local Area Network is the group of Computer and Devices Services provided in the geographical region of an individual.

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## UNIT - 9

## PEOPLE AND ENVIRONMENT

## Natural Hazards and Mitigation

## - MEANING OF ENVIRONMENT

$>$ Environment is simply the world around us-starting with our skin and reaching out in all directions, in ever widening circles, until it embraces the universe. Environment has no limits- it is whole, continuous, and indivisible. It is common to all living organisms-humans, animals and plants. The air, water, land, rocks, plants and animals are all part of environment.

## - MEANING OF ENVIRONMENT (CONT)

$>$ Environment also includes our neighbourhood, our village, our culture and society. The environment in this context refers to the complex set of natural and human- made conditions. These include physical, geographic, biological conditions along with societies, religion and culture, economies and political systems

## - TYPES OF ENVIRONMENT

> Natural Environment:- Plant and animal life, air, water, soil land, climate human made structures like roads, buildings, bridges, industries, parks etc.,
> Social Environment:- Individuals, family, communities, religious, educational, economic, and political institutions etc.,
> Cultural Environment: Culture differs from community to community and society to society. Culture is often shaped by natural environment and the interactions between individuals in a community. Culture changes overtime. Traditions shape our relationship with and impacts on the natural environment in a changing cultural environment.

## - POLLUTION

$>$ The word pollution is derived from the Latin word pulluere which means 'to soil or defile'. Any alteration to air, water, soil or food that threatens the health, survival capability or activities of humans or living organisms is called pollution.

## - NATURE OF POLLUTANTS

$>$ Pollutants are the substances that cause pollution, that is, substances that make the environment toxic, unhealthy or unpleasant, or adversely interfere in the natural functioning of ecosystems.
> There are two main categories of pollutants. Degradable and non degradable

## - DEGRADABLE AND NON DEGRADABLE POLLUTANTS

> Degradable Pollutants: These pollutants are the materials such as sewage, that can rapidly decompose by natural processes. These pollutants become a problem when added to the environment faster than they decompose

## - NON DEGRADABLE POLLUTANTS

> Non- Degradable Pollutants: These pollutants are the materials that do not decompose slowly in the natural environment. Once contamination occurs, it is difficult or impossible to remove these pollutants from the environment.
$>$ They include radio active materials and Persistent Organic Pollutants (POPs). POPs are produces or released into the environment due to human activity.

## - TYPES OF POPs

$>$ POPs are of three types:

1. Industrial chemical products like polychlorinated biphenyls (PCBs) earlies used as coolants and lubricants in electrical equipments
2. Pesticides like DDT, Aldrin, HCB (commonly known as gammaxine, used as disinfectant)
3. Dioxins and furans: These are chlorine-containing chemicals that may be released during burning of chlorine-containing materials (such as plastics) or processes using chlorine

## - SOURCES OF POLLUTION

$>$ There are mainly two sources of pollutants, Point sources, Non-Point Sources
> Point Sources: These sources are those which have a specific location. These include chemical plants, steel mills, oil refineries and municipal waste incinerator. Hazardous air pollutants may be released when equipment leaks, when material is transferred or emitted from chimneys. For example, municipal waste incinerators can emit hazardous levels of dioxins, as well as metals such as lead and mercury

## - SOURCES OF POLLUTION

$>$ Non Point (Dispersed) Sources: These sources broad unconfined areas from which pollutants enter the environment. In case of water pollution, or example, dispersed sources of pollution include surface runoff from farms carrying animal wastes, fertilizers, pesticides,
and silt into near by rivers and ponds. Urban storm water drains are also a dispersed source because they enter local rivers or lakes at many locations

## - AIR POLLUTION

The quality of air deteriorates when harmful substances, sound, radiations etc. emitted into the atmosphere from any activity reach unsafe levels.

## Important pollutants of air and their sources

## - Gases present in Air

## - NOISE POLLUTION

Noise is a common feature of our daily life. But very loud noise makes us irritable. Rail, road and air traffic, industrial machines, construction and mining create unwanted noise. Increasing noise has forced people to take a special note of noise pollution.

Odum: "Noise pollution is the unwanted sound dumped into the environment without regard to the adverse effect it may have"

Robert Koch: "Noise pollution like smog is a slow agent of death"

## - SOURCES OF NOISE POLLUTION

$>$ Industrial Noise: the noise emitted by the industries is some times more than 100decibles
$>$ Transport Vehicles: Noise from different transport vehicles like buses, trucks, trains helicopters especially in urban areas have lead to noise pollution
$>$ Noise fro neighborhood; Noises from neighborhood like musical instrument, TV, music systems, mixer-grinders, processions, crackers, mikes, functions etc

## - NOISE CHART

## - IMPACT OF NOISE POLLUTION

1. Variations in blood circulation leads to respiratory problems
2. Hearing capacity gradually decreases and may lead to partial or permanent deafness
3. Causes sleeplessness and leads to laziness
4. Working for a longer time in noise pollution my lead to loss of mental balance
5. Continuous exposure to noise between 90-120 dbls may result loss of sound identification
6. Noise pollution affects the foetus in the womb of the mother
7. Leads to emotional disturbances, uneven heart beat, brain, kidney and lever problems
8. Affects the digestive system

## - WATER POLLUTION

Water Pollution is the adverse change in composition or condition of water. Changes in clarity, temperature and smell of water tell us the possibility of pollution

There are laboratory procedures for testing the water for pollution. Unpolluted water is chemically neutral. Using a PH paper you can test the water for its acidity or alkalinity

Water Pollution includes chemical, physical or biological changes in fresh or ocean waters

## - TYPES OF WATER POLLUTANTS

> Disease Causing Agents: Which include bacteria, viruses, protozoa and parasitic worms enter water from domestic sewage and animal wastes. They are the biggest cause of water diseases. Some of which can be fatal.
> Oxygen Demanding Wastes: Are organic matter which need oxygen requiring bacteria to be decomposed. Large numbers of such bacteria while oxidising these waste deplete the dissolved oxygen in water, causing fish and other aquatic organisms to die.
> Inorganic chemicals which are soluble in water and consist of acids, salts and soluble compounds of toxic metals like mercury and lead which make water unfit to drink, harm fish and aquatic life affect corps and corrode materials. A large number of inorganic chemicals find their there way into both surface water and ground water from sources such as industries, mines, irrigation runoff, oil drilling and urban runoff from storm sewers.

## - TYPES OF WATER POLLUTANTS

> Inorganic Plant Nutrients: Like water soluble nutrients and phosphates, cause excessive growth of algae and other aquatic plants. When these aquatic plants die and decay, they decompose. This causes depletion of oxygen in water. This is harmful for the life forms in water.
> Heat and Warm Water: released from industrial discharges as part of their cooling processes raises water temperature and affects health and life cycles of aquatic flora and fauna.
> Radioactive substances: Include the waste from mining, and refinement of radio active metals and pollution caused by their use. Mining, agriculture, domestic waste and sewage water. Silt and sediments from erosion of top soil are considered pollutants because it can damage aquatic eco system

## - SOIL POLLUTION

> Land and soil pollution is the degradation of the earth's land surface. Retaining top soil intact is important for vegetation and agriculture. For inhabitation, aesthetics and other commercial and industrial purposes too, land and soil pollution is undesirable
> When industrial and urban waste, such as various chemicals, plastics, waste papers, rubber etc., are dumped on land, they can accumulate and interfere with life processes.
> Pesticides and fertilizers, fumigants and soil conditioners used in agriculture can accumulate in the soil in a dispersed form. This is particularly seen in the case of pesticides like DDT which are used to kill certain pests, but their quantities reach such levels that they can do harm to other forms of life. Mining leads to severe physical and chemical disturbances in land and soil structure

## - RADIOACTIVE POLLUTION

Radioactive substances emit energy in the form of radiation. The radiations having energy more than that in ultraviolet rays are called ionizing radiations. They are called ionizing radiations because they can produce charged particles in matter. Exposure to these ionizing radiations can be dangerous

Radioactive Pollutants: There is a "background" of natural radiation everywhere in our environment. It comes from space i.e., cosmic rays and from naturally occurring radioactive materials continued in the earth and in living things.

In the natural environment radiations are always being emitted from terrestrial sources and from the cosmic rays from the space but these emissions are of very low level since the beginning of life every living beings is exposed to natural radiation. Only in the case of heavy exposure to radiations such as caused by nuclear weapons or in the case of accidental exposure nuclear material.

## - Peroxyacetyl nitrate(PAN)

> Peroxyacetyl nitrate is a peroxyacyl nitrate. It is a secondary pollutant present in photochemical smog. It is thermally unstable and decomposes into peroxyethanoyl radicals and nitrogen dioxide gas.
$>$ Peroxyacetyl nitrate, or PAN, is an oxidant more stable than ozone. Hence, it is better capable of long-range transport than ozone. It serves as a carrier for oxides of nitrogen (NOx) into rural regions and causes ozone formation in the global troposphere.
$>$ The formation of PAN on a secondary scale becomes an issue when ethanol is used as an automotive fuel. Acetaldehyde emissions increase, which subsequently react in the atmosphere to form smog. Whereas ethanol policies solve domestic oil supply problems, they drastically exacerbate air quality conditions.
> The Earth's Layers
> The Earth is divided into FOUR layers.

1. ATMOSPHERE
2. HYDROSPHERE

## 3. LITHOSPHERE

4. BIOSPHERE

## - ATMOSPHERE

The enevelop of air that completely surround the earth is called the atmosphere. It contains oxygen in abundance. The atmosphere is further divided into 4 layers. Which is discussed further

## - HYDROSPHERE

$>$ The oceans, lakes, rivers and other water bodies on the earth form the hydrosphere. As there is a lot of water on the earth it is called a watery planet. However more than $97 \%$ of water is not available for human use, as it is saline. $2 \%$ of the total amount of water is frozen only $1 \%$ is available as fresh water

## - LITHOSPHERE

> This layer envelops the interior of the earth. Its average thickness is 60 kms . Surrounding the mantle is the lighter rocks called SIAL. (Silicate and Aluminum) which overlies denser rocks SIMA(silicate and mangenese). The crust under the continents specially the high mountain ranges is between 30 to 75 kms thick. Beneath the ocean is only 6 to 8 kms thick. The earth core is metallic in nature containing nickel and iron. The lithospher is made up of various layers of rocks containing many types of minerals

## - BIOSPHERE

$>$ It is the unique feature of earth. Biosphere merges into the atmosphere, hydrosphere and lithosphere. It is that portion of earth that is alive or where life exist. It extends from the bottom of the ocean to several Kms in the atmosphere. It is suitable for the existence of living organisms as it has air, water, soil and energy.
> The Earth's Inner Layers
> Crust
> The crust is the layer that you live on so it is the most widely studied and understood.
> Crust
$>$ The crust is made of the lightest matter and the core consists of heavy metals
> Crust

- The Earth's Crust is like the skin of an apple. It is very thin in comparison to the other three layers.


## - Crust

1. The crust of the Earth is broken into many pieces called plates. The plates move along the soft mantle which is the layer located located below the crust.

## - Crust

> The plates move along smoothly but sometimes they get stuck and pressure builds up.
> Crust
The pressure builds and causes an Earthquake as rocks break and crack.
> Mantle
> The mantle is the largest layer of the Earth.
> It is made of hot, dense rock. The rock in the mantle flows like asphalt because of the temperature differences found in the mantle.
> Mantle
$>$ The movement of the mantle create the movement of the Earth's plates.
> Core
> The core of the Earth is much like a ball of very hot metals. The inner core is surrounded by a fluid iron outer core.
> Core

- LAYERS OF ATMOSPHERE


## TROPOSPHERE

This layer starts at the earth's surface and extends to 14.5 kms high
$>$ This is the bottom layer of the atmosphere
$>$ This part of the atmosphere is the densest and consists of various gases, dust particles and water vapour
$>$ Most of the weather processes like clouds, rain and snow occur in this layer
$>$ High mountains have snow even in the summer months because temperature drops from about $17 * \mathrm{C}$ to $-52^{*} \mathrm{C}$ as one climbs in this layer.
> This is known as lower atmosphere
> LAYERS OF ATMOSPHERE

## STRATOSPHERE

> This layer starts just above the troposphere and extends 50 kms high
> This part of the atmospheric layer is dry and less dense as compared to troposphere
$>$ The temperature in this region of the atmosphere increases (gradually to $-3 *$ c)
> LAYERS OF ATMOSPHERE

## MESOSPHERE

> This layer starts just above the stratosphere and extends 85 kms high
$>$ In this region, the temperatures fall to as low as $-93^{*} \mathrm{C}$ as altitude increases
> The regions of the stratosphere and the mesosphere are together referred to as the middle atmosphere

## > LAYERS OF ATMOSPHERE

## THERMOSPHERE

> This layer starts just above the mesosphere and extends 600 kms high
> This layer is known as the upper atmosphere
$>$ Temperature in this region can go as high as $1,727^{*} \mathrm{C}$. The temperatures are very high in this layer because the gaseous molecules here are constantly bombarded by high-energy solar radiation
> A small variation/change in solar energy causes a large change in temperature in this layer
$>$ Chemical reactions occur much faster here than on the surface of the earth, because of the high temperatures

## > DISTRIBUTION OF WATER ON EARTH

## > EXPLOITATION OF NATURAL RESOURCES AND ENERGY

## Natural Resources: Air, Water and Soil.

Uses of Water: for life, agriculture, industry, power, domestic use, waste disposal
Soil: Soil provides various natural resources that we require for living. These include food, medicines, timber, minerals and bio mass.

Air: For living of animals, plants and many more. The earth is surrounded by layer of air (atmosphere) without atmosphere there would be no life on earth and also no weather. The atmosphere recycles water and moderates the electrical and magnetic forces that act upon the earth and protects us from ultra violet radiations from sun.

## - EXPLOITATION OF ENERGY

Energy is the power of the strength required for any activity. Energy is required for the living processes of all plants and animals. As living beings we require energy for our own bodily functions, which we get from our food. Humans are part of ecosystems. In pre historic times, human activities were within the natural cycling and processes of ecosystems. With the changes in human living patterns, the pattern of consumption of energy has also changed

## - EXPLOITATION OF ENERGY

> Domesticated animals
> Wood and Biomass
$>$ Solar Energy
> Moving wind and water; Hydropower, wind energy, sea-wave energy and Tidal energy,
> Geothermal Energy
> Fossil Fuels: Solid fuels-wood, coal, coke, charcoal, paraffin wax. Liquid fuels-kerosene, petrol, diesel, alcohol, bio-diesel etc. Gaseous fuels-natural gas, liquefied petroleum gas, biogas etc

Nuclear energy

## UNIT - 10

## HIGHER EDUCATION

## Institutions of Higher learning and education in ancient India:

 Introduction:India has a rich tradition of learning and education right from the antiquity. These were handed over generations to generations either through oral or written medium. A single feature of ancient Indian or Hindu civilization is that it has been molded and shaped in the course of its history more by religious than by political, or economic influences. The fundamental principles of social, political, and economic life were welded into a comprehensive theory, which is called Religion in Hindu thought. The total configuration of ideals, practices, and conduct is called Dharma (Religion, Virtue or Duty) in this ancient tradition. Indian culture is suffused thoroughly by religious values. The approach of our forefathers to life, their subtle analysis and codification of duties, all indicate their cherished spiritual values. Their political as well as social realities were not circumscribed within the narrow geographical bounds. Their attitude to life was characterized by width of vision and they identified their duty with devotion to the ideal of 'summum bonum' of mankind. Multi-dimensional progress of all mankind became the sole objective of her civilization.

The ancient Indian polity, eschewing the imponderables of violence, friction and selfaggrandizement, was based on the principles of love, honourable conduct and good behaviour. Life had a definite aim, an ideal and the attainment of which was thought to transcend all material achievements. The educational evolution in ancient India was also founded upon this very ideal. Dr. R.K. Mukherjee said, Learning in India through the ages had been prized and pursued not for its own sake, if we may so put it, but for the sake, and as a part, of religion. It was sought as the means of self-realization, as the means to the highest end of life viz. Mukti or 2 Emancipation. Ancient Indian education is also to be understood as being ultimately the outcome of the Indian theory of knowledge as part of the corresponding scheme of life and values. The scheme takes full account of the fact that Life includes Death and the two forms the whole truth. This gives a particular angle of vision, a sense of perspective and proportion in which the material and the moral, the physical and spiritual, the perishable and permanent interests and
values of life are clearly defined and strictly differentiated. Of all the people of the world the Hindu is the most impressed and affected by the fact of death as the central fact of life. The individual's supreme duty is thus to achieve his expansion into the Absolute, his self-fulfillment, for he is a potential God, a spark of the Divine. Education must aid in this self-fulfillment, and not in the acquisition of mere objective knowledge.

## Philosophy of Life in Ancient India

The outstanding characteristics of the ancient philosophy of life in India are that while no great significance is attached to the physical existence in the world, yet the importance of action in this material world is not overlooked. The doctrine of action (Karma) occupies a very significant place in the Indian system of life and of education. Action or Karma should not be for the redemption of mankind. This has been the ideal of the doctrine of karma as also of the educational system of ancient India. Hence, the ultimate object of devotion for an individual is the Brahma and not this world. The material world is the lab of the human soul where the individual has to receive systematic education for bringing about self development. The ancient Aryan culture of India lays the greatest emphasis on plain living and high thinking as the moral basis of education for self development. Consequently, the individual has been bidden necessarily to gain both kinds of knowledge, materialistic and spiritual. All fields of vidya or knowledge were thus divided into two broad streams-the paravidya (the higher knowledge, the spiritual wisdom) and 3 the aparavidya (the lower knowledge, the secular sciences.) The latter is needed to live a comfortable life here. The former helps one to be fully prepared for the hereafter. Hence a balanced combination of both is advocated so that both civilization and culture are imparted.

The materialistic education embodies various aspects of the knowledge of physical sciences. It is for a student that the developed social structure exists. The student engaged in the pursuit of material knowledge has consequently been treated as the fulcrum or the axis of the social structure, for in his development lies the well being of the society. Spiritual knowledge has been regarded as the means of attaining the final beatitude. For the realization of the great truth, deep meditation in privacy is essential and hence the individual has been bidden to take recourse to severe penance (Tapa) once again. The devotee of spiritual knowledge has been enjoined upon to keep aloof from material objects and to consume himself wholly in self-meditation because the main elements constituting divine or spiritual knowledge cannot be understood and realized through hearing or by means of intellect. These can be realized only through divine graciousness.

## Fundamentals of Ancient Indian Education

Ancient Indian Education had been evolved strictly on the foundations of Indian epistemological and philosophical traditions. The idea of the ephemerality of life and the world, the concept of ultimate death and the futility of mundane pleasures had provided them with a special angle of vision. The entire educational tradition originated in these 4 principles. Thus, the

Indian sages devoted themselves to the study of a Supra-sensible world and spiritual powers and moulded their life accordingly. The ultimate aim of education emerged as the Chitti-Vrittinirodha (the control of mental activities connected with the so called concrete world). However, education did not neglect the development of the pupil's powers for his all-sided advancement.

## 1. Knowledge related to life

During the ancient times in India, the pupil away from the haunts of din and distractions of the material world, amidst beautiful natural surroundings, sitting at the feet of his teacher, would comprehend all the intricate problems of life through listening and meditation. He would not remain contended with mere bookish learning but acquire fairly practical knowledge of the world and society through close contact with the people. An attempt was made to make the student capable of experiencing the Supreme truth himself and mould the society accordingly.

## 2. Close association between teacher and student resulted in all round development

The residence of the pupil at the house of the teacher accompanied by a sense of devoted service had been a unique tradition in ancient India. The pupil, through such a close contact with his teacher, would naturally imbibe his qualities through emulation. This was regarded as indispensable for the fullest development of his personality because the teacher was supposed to symbolize all the good ideals, traditions and code of behavior of the society from where the pupil hailed.

## 3. Development in social work

Another important characteristic of ancient Indian educational system was that the same was wedded to the practical ends of life. The pupil's residence at his teacher's house would make it possible for him to develop social contacts as it was his sacred duty to collect fuelwood, 5 supply water and do other household odd jobs for the teacher. In this way, not only would he receive instructions related to domestic life, but also learn the concrete lesson of the dignity of labour and social service.

## 4. Vocational training

Students were given training in occupations of animal husbandry, agriculture and dairy farming etc. by tending his teacher's cows and serving him in diverse ways. Evidently, the ancient Indian education was not merely theoretical but was related to the realities of life. The modern concept of Learning by Doing as understood in the West today, was the very core and essence of education in ancient India. Life served as the laboratory for the educational experimentation from where many noble traditions were developed. Similarly, begging alms by the pupils for their own subsistence and service of the Guru fostered in them humanitarian virtues.

## The Four Vedas

The Vedas regarded as the oldest among the literatures of the world, are the original sources of the philosophy of life in ancient India. A study of these Vedas will enable one to get a thorough knowledge not only of the philosophy of life but also of the whole fabric of ancient Indian culture. Consequently, the entire literature and philosophy of India, The Upanishads, the Smritis and the Puranas, all acknowledge the superiority of Vedas. The Vedas occupy a very important place in the Indian life. The 6 basis of Indian culture lies in the Vedas, which are four in numberRigveda, Samaveda, Yajurveda and Atharvaveda. Vedas have their own characteristic features. Through them we are able to know about the culture, civilization, life and philosophy of people in ancient India. Vedas symbolize the chief objective of human life, which has been deliberance from this world of births and deaths. The Indian philosophy of life has never accepted life as purposeless.

## The Rig Veda

The Rig Veda is established as the earliest work not merely of the Hindus, but of all IndoEuropean languages and humanity. It lays the foundation upon which Hindu Civilization has been building up through the ages. Broadly speaking, it is on a foundation of plain living and high thinking. Some of the prayers of the Rig Veda, like the widely known Gayatri mantram also found in Samaveda and Yajur Veda touch the highest point of knowledge and sustain human souls to this day. The Rig Veda itself exhibits an evolution and the history of the Rigveda is a history of the culture of the age.

## Other Vedas

Following Rigveda, came into existence the three Samhitas of Sama, Yajuh and Atharva in close succession. These Vedas ushered in a new kind of literature. The order of hymns included in the Rigveda is not in accord with that of the sacrifices; so much so there are some such hymns as have no relation to the Yajna or sacrifice at all. On the contrary, in the Sama, Yajuh and Atharva the hymns follow closely in order of the sacrifices. Priesthood was gaining ground. Higher education later on related itself to priesthood and the ritualistic aspect of religion. The curriculum of education was the same for all the students called 7 Brahmacharinis; each of them was required to attain proficiency in the melodies of verses and ritualistic aspects of yajna. In course of time however, essentiality of division of labour was strongly felt owing to the growing complex nature of formal aspect of sacrifice, because no single individual priest could be expected to specialize in the triple aspect of the yajna.

## Method of Teaching

Two methods of teaching were being practiced during the Vedic period. The first method was Oral and the second was based on Chintan i.e. thinking. In the oral method the students were to memorize the Mantras (Vedic hymns) and Richayas (verses of Rigveda) in order that
they might 10 not be changed wrongly and they might remain preserved in their original forms. Thinking method was another part of the teaching method. Through this an attempt was made to reserve the Veda Mantras and Richayas.

The thinking principle, Manana Shakti was reckoned higher than the subject of thinking. So the primary subject of education was the mind itself. According to the ancient Indian theory of education, the training of the mind and the process of thinking, are essential for the acquisition of knowledge. So the pupil had mainly to educate himself and achieve his own mental growth. Education was reduced to the three simple processes of Sravana, Manana and Niddhyaasana. Sravana was listening to the truths as they fell from the lips of the teacher. Knowledge was technically called Sruti or what the ear heard and not what was seen in writing. The second process of knowledge called Manana implies that the pupil has to think out for himself the meaning of the lessons imparted to him orally by his teacher so that they may assimilate fully. The third step known as Niddhyasana means complete comprehension by the pupil of the truth that is taught so that he may live the truth and not merely explain it by word. Knowledge must result in realization. Just as in modern days teachers encourage intelligent students by guiding them to make research, similarly in ancient days Manan (reflection) was a method especially for highly intelligent students.

## Forms of Educational Institutions

Broadly there existed three types of institutions namely Gurukulas, Parishads(Academies) and Sammelans (Conferences) in that age. According to sacred texts, the training of the Brahmin pupil took place at the home of a Brahmin teacher. In some texts the guru is depicted as the poor ascetic and it is the duty of the student to beg for his teacher. The first lesson that was taught to the student was the performance of sandhya and also reciting of gayatri. The family functioned as a domestic school, an ashram or a hermitage where the mental faculties of the pupils were developed by the teacher's constant attention and personal instruction. Education treated as a matter of individual concern, did not admit of the method of mass production applicable in industry. The making of man was regarded as an artistic and not a mechanical process. Indeed, the aim of education was the developing of the pupil's personality, his innate and latent capacities. This view of education as a process of one's inner growth 16 and self-fulfillment evolved its own technique, its rules, methods and practices. Besides these regular schools of instructions, there were special institutions for the promotion of advance study and research. These are called in the Rig Veda as Brahmana- Sangha. These Academics were called Parisads; there is a reference to the Panchala Parisad in the Upanishads, in whose proceedings even kings participated. These Academies were the main forums where students belonging to higher order of learning gathered and quenched their insatiable thirst for knowledge through discussions and discourses. Learning was also prompted by discussions at public meetings, which were a regular of rural life, and were addressed by wandering scholars. These scholars toured the country to deliver public
discourses and invite discussion. The Brahmanas, the Aranyakas and the Upanishads abound in such instances. Besides the local councils or academies of disputants, there were invited occasionally by some great king, several scholars, Rishis, philosophers and psychologists to a national gathering for the sake of discussions and debates. The ablest and best scholars, speakers, philosophers and thinkers were awarded special prizes for their merits. In addition to the above mentioned forms of educational institutions, courts of kings too, served as important centers of learning where several scholars and philosophers, hailing from different countries, would flock together, talk, discuss and throw light on metaphysical, theological and other problems.

## Conclusion

To sum up, in ancient India secular vocational training was essentially a practical and useful education. There was complete absence of formal paraphernalia of education required in modern times; education was imparted by the father to his son according to practical and direct method. Industrial occupations were at the peak. Indian artists have bequeathed to the world many fine artistic creations, which will be regarded as the valuable treasure of the past, present as well as the future.

## Evaluation of Higher Learning and Research in Post Independence India:

Evolution of Higher Learning and Research in Post Independence India: our country has always been identifies as knowledge hub since the beginning of human civilization. Indian higher education system has been witnessing metamorphic changes and challenges through the years, i.e. from the ancient Gurukul system to the modern technology-based learning system have changed the life of millions of people.

India always been identified as knowledge hub since the beginning of human civilization. Indian higher education system has been witnessing metamorphic changes and challenges through the years, i.e., from ancient Gurukul system to the modern technology based learning system have changed the life of millions of people.
$>$ This is evident from centers of learning which existed in the 7th century BC were the Buddhist monasteries and in the 3rd century AD was Nalanda. Few of these centers were very large having several faculties. Invasions and disorder in the country has extinguished ancient Indian education system.
$>$ First college was set up in 1918 in Serampore in Bengal imparting western education in India. In 1857, three Central Universities of Calcutta, Bombay and Madras were set up, 27 colleges were affiliated. In 1947, 19 Universities were there in India. (CABE, 2005).
> The Higher education system in India has grown in remarkable way after post independence period and become the largest Higher Education System in the world.
> The Indian higher education system as developed its own system and structure. Since the Indian constitutions provides for joint responsibility of the union and state government for promotion of education.
> The linkage between learning, research and innovation within higher education is the key to the building of sustainable knowledge societies.
$>$ Based on the provisions for academic, administrative and financial flexibility, there are different types of universities and institutions in the higher education system in the country India has different High.
> India has different Higher education institutions namely, central and state universities, unitary and affiliating universities, institutions of national importance, deemed to be universities and open universities.
$>$ The central government via the University Grants Commission (UGC) or the AICTE provides support to various state run university. Universities in India functionally are multi-faculty universities, single faculty universities (agricultural, technological and medical universities) apart from the universities there also institutions of national importance like IITs, IIMs deemed to be universities (BITS, IISc).
$>$ Higher education system in the country is governed by multiple agencies with University Grant Commission (UGC) as the apex body.
> The rule and regulations by these agencies makes the higher education system more complex. The various stakeholders in the regulatory framework in the country are State governments, professional councils like University Grant Commission (UGC), All India Council for Technical Education (AICTE) etc.

The growth of Higher education in India after post-independence is phenomenal. It is more than half a century ever since the government initiated a planned development of higher education in the country particularly with the establishment of University Grants Commission in 1953. During 1950 and 2012 the number of universities has increased from 20 to about 659, and colleges from 500 to 33023, and teachers from 15,000 to 9.46 lakhs.

## Radhakrishnan Commission (1948-49)

> The first major commission to study the state of the universities in India after independence was the Radhakrishnan Commission (also known as the University Education Commission) in 1948-49.
> The Commission was appointed with the specific aim 'to report on Indian University Education and suggest improvements and extensions that may be desirable to suit present and future requirements of the country'.
$>$ A major chapter in the Radhakrishnan Commission report was devoted to the problem of the medium (language) of instruction at the university level. The most significant recommendation of the Commission was that a University Grants Commission modelled on the University Grants Committee in Great Britain be set up as a liaison between the central government and the universities.
> This last recommendation became a reality in 1956 when the University Grants Commission (UGC) was established by an act of Parliament which stated that "The Constitution of India vests Parliament with the exclusive authority in regard to coordination and determination of standards in institutions of higher education and research and scientific and technical institutions."

## Secondary education Commission ( Mudaliar Commission):-

The Secondary Education Commission was appointed by the Government of India Resolution on 23rd September 1952 under the Chairmanship of Dr. A. Lakshmanaswami Mudaliar, ViceChancellor, Madras University to examine the prevailing system of secondary education in the country.
it was aimed to suggest measures for its reorganization and improvement with reference to the aims, organisation and content of secondary education, its relationship to primary and higher education and the interrelation of secondary schools of different types.

## Kothari Commission 1964:-

The Commission was appointed under provision of a resolution of the Government of India, dated 14th July, 1964and it began its task on October 2,1964 .
$>$ The Commission included eminent educationists in diverse fields from India and abroad. It consisted of total 17 members, where 14 members, 1 member - secretary, 1 Associate Secretary and Dr. D.S. Kothari, chairman of the U.G.C. was appointed as the chairman of the commission. Therefore, it is also known as the Kothari Commission.
$>$ The Commission submitted its report to the Government on June 29,1966. It was laid on the Table of the House on August 29, 1966. The report of the Commission, is a voluminous document of about 700 pages. It has been hailed as referred for all change and reform in Education.
$>$ Although it is 20 years old, yet it maintains its fragrance and freshness. Even the new National Policy on Education (1986) has been mainly based on its recommendations. It is termed as Bible for Teachers‘ and should be read with flair.

## Rammurthy Review Committee:

> The committee to review the National Policy on Education 1986, was formed on 7thNovember 1990 with Acharya Ramamurthy as Chairman and sixteen others as members. This Committee's report bears the title ${ }^{-}$Towards an Enlightened and Humane Society?.
$>$ The Committee was appointed to review the National Policy on Education 1986 and make recommendations regarding the revision of the policy and action necessary for implementation of the revised policy within a time-frame.

## Role of Department of Higher Education:

$>$ Enhancement of Gross Enrollment Ratio by expanding access through all modes.
$>$ Promoting the participation of these sections of the society whose GER is lower than the national average.
> To improve quality and to promote academic reforms Setting up of new educational institutions and also capacity expansion and improvement of the existing institutions.
> Use of Technology in Higher Education. Development of Vocational Education and Skill Development.
> Development of Indian Languages. International Collaboration in the field of education.

## Professional, Technical and Skill Based education:

Skill development is key feature in every individual's life if he/she want to be employed. Every country needs individuals with higher level of skills and educational qualification. We can't say that people with good educational qualification will surely get employment or skilled person will definitely get a job. An individual who want to get employed will have two possess both the things together i.e. good education and higher level of skills.

What employers are looking for are individuals who have the ability to communicate, solve problems and teamwork. The skill development ecosystem in India is complex, large and diverse, providing varied levels of skills across an extremely heterogeneous population. Skill development in India can be broadly segmented into Education and Vocational Training.

Elementary, secondary and higher education is governed by the Ministry of Human Resource Development. University and Higher Education caters to all college education (Arts, Science, Commerce, etc.), while engineering education, polytechnics, etc. fall under Technical Education.

University Grants Commission (UGC) is the nodal body governing funds, grants and setting standards for teaching, examination and research in Universities, and the All India Council for Technical Education (AICTE) is the regulatory body for Technical Education in India.

At the central level, the nodal institution for vocational training is the Director General of Employment \& Training (DGET) under the Ministry of Labor and Employment. The DGET is
responsible for formulating policies, establishing standards, granting affiliation, trade testing and certification, and matters connected to vocational training and providing employment services. The National Skill Development Council (NSDC) - now a part of the newly created Ministry of Skill Development and Entrepreneurship - was initially set up under the Ministry of Finance to provide viability gap funding and promote private skill initiatives.

## History of skill development

The government has to put massive effort to form better educational structure especially for skill development sector comprising of industry oriented training. A number of special initiatives are rolled by Government.

## POLICY FRAMEWORK

The government has listed skill development as one of its priorities and aims to enhance participation of youth, seek greater inclusion of women, disabled and other disadvantaged sections into the workforce, and improve the capability of the present system, making it flexible to adapt to technological changes and demands emanating from the labor market.

## The Apprenticeship Act of 1961

> Apprenticeship programmes in India are governed by The Apprentice Act of 1961 and the Apprenticeship Rules of 1992.
$>$ The Apprentice Training Scheme is implemented by the ministries of Labour and Employment and Human Resource Development.
> The Ministry of Labour and Employment oversees 'trade apprentices' through six regional offices. The Ministry of Human Resource Development oversees 'graduate, technician, and technician (vocational) apprentices' through four boards located in different cities.
$>$ One of the objectives of apprenticeship was also to ensure that employers get skilled workforce having adequate exposure to real work environment.
> The Apprentice Protsahan Yojana was also launched to support MSMEs in the manufacturing sector in engaging apprentices. As per the amended Act, work hours and leave benefits of Apprentices will be at par with the regular workers from the organized sector.

## National Skill Policy

The National Policy on Skill Development was first formulated in 2009 to create a skills ecosystem in India. It acts as a guide to formulate strategies by addressing the different challenges in skill development.

The policy aims to provide an umbrella framework to all skill related activities carried out within the country, to align them to common standards and link skill activities with demand centres.

The new skills policy also provides details on how skill development efforts across the country can be aligned within the existing institutional arrangements.

## The National Skills Qualification Framework

The National Skills Qualifications Framework (NSQF), notified on 27th December 2013, is a competency-based framework that organizes all qualifications according to a series of levels of knowledge, skills and aptitude.

Presently, more than 100 countries have, or are in the process of developing national qualification frameworks. Under NSQF, the learner can acquire the certification for competency needed at any level through formal, non-formal or informal learning. The NSQF is anchored at the National Skill Development Agency (NSDA) and is being implemented through the National Skills Qualifications Committee (NSQC) which comprises of all key stakeholders.

The NSQF provides for a five-year implementation schedule and at the end of the fifth year (2018), it shall be mandatory for all training/educational programmes/courses to be NSQF compliant, and all training and educational institutions shall define eligibility criteria for admission to various courses in terms of NSQF levels.

## Nodal bodies for Skill Development in India

 Ministry of Skill Development and Entrepreneurship$>$ The creation of the first-ever separate Ministry of Skill Development and Entrepreneurship was announced by Prime Minister Narendra Modi in June 2014.
> It is conceived to encompass all other ministries to work in a unified way, set common standards, as well as coordinate and streamline the functioning of different organizations working for skill development.

## MHRD

The Ministry of Human Resource and Development (MHRD) governs the polytechnic institutions offering diploma level courses under various disciplines such as engineering and technology, pharmacy, architecture, applied arts and crafts and hotel management.
> MHRD is also involved in the scheme of Apprenticeship Training.
$>$ Apart from this, MHRD has also introduced vocational education from class IX onwards, and provides financial assistance for engaging with industry/SSCs for assessment, certification and training.

## Central Ministries

$>$ There are 21 Ministries under the central government who are also working for the purpose of skill development.
$>$ There are two approaches that these Ministries have: one approach is setting up training centres of their own for specific sectors like (adopted by Ministry of Labour \& Employment, Ministry of Agriculture, Ministry of Health \& Family Welfare, etc.). The second approach is in the form of Public Private Partnership (as adopted by Ministry of Rural Development, Ministry of Women and Child Development, etc.).

## NSDC

The National Skill Development Corporation India (NSDC) is a public private partnership organization (now under the Ministry of Skill Development and Entrepreneurship) that was incorporated in 2009 under the National Skill Policy.

## The main objectives of the NSDC are to:

> Upgrade skills to international standards through significant industry involvement and develop necessary frameworks for standards, curriculum and quality assurance Enhance,
> support and coordinate private sector initiatives for skill development through appropriate Public-Private Partnership (PPP) models; strive for significant operational and financial involvement from the private sector
> Play the role of a "market-maker" by bringing financing, particularly in sectors where market mechanisms are ineffective or missing
> Prioritize initiatives that can have a multiplier or catalytic effect as opposed to one-off impact.

## Sector Skill Councils

$>$ The National Skill Development Policy of 2009 mandated the NSDC to setup SSCs to bring together key stakeholders i.e. industry, work force and academia. As on date, 29 SSCs are operational and 4 more SSCs have been approved by NSDC.
$>$ They are funded by NSDC for the initial few years and are expected to become financially self-sustaining as they grow

NCVT, SCVT and Quality Council of India
Established under Ministry of Labor and Employment with a view to ensure and maintain uniformity in the standards of training all over the country, the National Council for Vocational Training (NCVT) was set up in 1956.
$>$ This certifying body conducts All India Trade Tests for those who complete training in ITIs and awards National Trade Certificates to successful candidates.
> The Council has representation from central and state government departments, employers' and workers' organizations, professional and learned bodies, All India Council for Technical

Education, scheduled castes and scheduled tribes, All India Women's Organization, among others.
$>$ The State Council for Vocational Training (SCVT) at the state levels and the sub committees have been established to assist the National Council. The Quality Council of India (QCI) was set up jointly by Government of India and the Indian industry as an autonomous body to establish a national accreditation structure in the field of education, healthcare, environment protection, governance, social sectors, infrastructure, vocational training and other areas that have significant bearing in improving the quality of life.
$>$ All institutions (Government and private ITIs) seeking formal affiliation from NCVT have to first get accreditation from the Quality Council of India.

## Industrial Training Institutes:

$>$ The DGET which governs Industrial Training Institutions (ITIs) has recently been aligned with Ministry of Skill Development and Entrepreneurship. There are more than 10,000 ITIs with a capacity of approximately 1.5 million seats.
$>$ The DGET also governs RVTIs (Regional Vocational Training Institutions) and ATIs (Advance Training Institutions) focusing on specialized and high-end skill sets and trainers courses.
$>$ Three major skill development schemes of the DGET that are being implemented through government ITIs and private ITCs include the Craftsmen Training Scheme, the Apprenticeship Training Scheme, and the Modular Employability Scheme.
Alongside the daunting challenge of skilling millions of youth entering workforce each month, India also faces a huge challenge of evolving a skill development system that can equip the workforce adequately to meet the requirements of the industry.

The workforce needs to be trained across four levels, from the high end specialized skills for 'White Collar' jobs to the low-level skills of the 'Rust Collar' jobs. Moreover, these skills have to be adequately linked to the available job opportunities. Several factors have inhibited the skill development eco-system in India to scale up to the desired levels. The skill development system in India is plagued with multiple issues related to awareness, perception, cost, quality and scale.

## Value education and environmental education

## Introduction:

The concept of value is gaining importance because of the present unwholesome condition of society where higher values are given scant recognition. Value is associated with what fulfils or has the capacity of fulfilling the needs of man. Which might be physical, psychological or
spiritual? As a chief exponent of Indian philosophy and way of living. Value Education is not altogether a new subject in education. It is deep-rooted in Indian soil with historical and cultural background; its roots can be traced out in moral ethical, spiritual and religious education. Martin Luther king well thought of the glory of a nation in the following words. "The prosperity of a country depends not on the abundance of its revenues nor on the strength of its fortification, nor on the beauty of its public buildings; but its cultivated citizens, in its men of education, enlighten and character." in India, Maharashtra government has made value education compulsory from 1997.Researches on value education is getting momentum. Here I am going to highlight some of the researches done so far.

## Meaning of Value-Education

The very purpose and main function of education is the development of an all round and well-balanced personality of the students, and also to develop all dimensions of the human intellect so that our children can help make our nation more democratic, cohesive, socially responsible, culturally rich and intellectually competitive nation.

## Objectives of Value Education

Traditionally the objectives of value-education were based on religion and philosophy. There was no secular value-education; but in today's modern world, this has been taken as very much essential.

Accordingly, the objectives for value-education may be taken up as Follows

1. Full development of child's personality in its physical, mental, emotional and spiritual aspects,
2. Inculcation of good manners and of responsible and cooperative citizenship.
3. Developing respect for the dignity of individual and society.
4. Inculcation of a spirit of patriotism and national integration.
5. Developing a democratic way of thinking and living.
6. Developing tolerance towards and understanding of different religious faiths.
7. Developing sense of brotherhood at social, national and international levels.
8. Helping pupils to have faith in themselves and in some supernatural power that, is supposed to control this universe and human life.
9. Enabling pupils to make decisions on the basis of sound moral principles
10. Evolving the evaluation criteria on value-education.
11. Suggesting measures for better utilization of value-education.
12. Finding out the interests of pupils in relation to different aspects and activities of valueeducation.
13. Clarifying the meaning and concept of value-education.

## Types of values

We can speak of universal values, because ever since human beings have lived in community, they have had to establish principles to guide their behaviour towards others. In this sense, honesty, responsibility, truth, solidarity, cooperation, tolerance, respect and peace, among others, are considered universal values. However, in order to understand them better, it is useful to classify values according to the following criteria:

## 1. Personal values

These are considered essential principles on which we build our life and guide us to relate with other people. They are usually a blend of family values and social-cultural values, together with our own individual ones, according to our experiences.

## 2. Family values

These are valued in a family and iare considered either good or bad. These derive from the fundamental beliefs of the parents, who use them to educate their children. They are the basic principles and guidelines of our initial behaviour in society, and are conveyed through our behaviors in the family, from the simplest to the most complex.

## 3. Social-cultural values

These are the prevailing values of our society, which change with time, and either coincide or not with our family or personal values. They constitute a complex mix of different values, and at times they contradict one another or pos a dilemma. For example, if work isn't valued socially as a means of personal fulfilment, then the society is indirectly fostering "anti-values" like dishonesty, irresponsibility, or crime. Another example of the dilemmas that social-cultural values may pose is when they promote the idea that "the end justifies the means". With this as a pretext, terrorists and arbitrary rulers justify violence, intolerance, and lies while claiming that their true goal is peace.

## 4. Material values

These values allow us to survive, and are related to our basic needs as human beings, such as food and clothing and protection from the environment. They are fundamental needs, part of the complex web that is created between personal, family and social-cultural values. If exaggerated, material values can be in contradiction with spiritual values.

## 5. Spiritual values

They refer to the importance we give to non-material aspects in our lives. They are part of our human needs and allow us to feel fulfilled. They add meaning and foundation to our life, as do religious beliefs. 4.6 Moral value The attitudes and behaviours that a society considers essential for coexistence, order, and general well being.

## Importance and functions of values

Values are general principles to regulate our day-to-day behaviour. They not only give direction to our behaviour but are also ideals and objectives in themselves. Values deal not so much with what is, but with what ought to be; in other words, they express moral imperatives. They are the expression of the ultimate ends, goals or purposes of social action. Our values are the basis of our judgments about what is desirable, beautiful, proper, correct, important, worthwhile and good as well as what is undesirable, ugly, incorrect, improper and bad. Pioneer sociologist Durkheim emphasised the importance of values (though he used the term 'morals') in controlling disruptive individual passions.

He also stressed that values enable individuals to feel that they are part of something bigger than themselves. Modem sociologist E. Shils (1972) also makes the same point and calls 'the central value system' (the main values of society) are seen as essential in creating conformity and order. Indian sociologist R.K. Mukerjee (1949) writes: "By their nature, all human relations and behaviour are imbedded in values."

The main functions of values are as follows

1. Values play an important role in the integration and fulfilment of man's basic impulses and desires in a stable and consistent manner appropriate for his living.
2. They are generic experiences in social action made up of both individual and social responses and attitudes.
3. They build up societies, integrate social relations.
4. They mould the ideal dimensions of personality and range and depth of culture.
5. They influence people's behaviour and serve as criteria for evaluating the actions of others.
6. They have a great role to play in the conduct of social life.
7. They help in creating norms to guide day-to-day behaviour.

## Value Education:

Definition and the Concept of Value Education Values' education is a term used to name several things, and there is much academic controversy surrounding it. Some regard it as all aspects of the process by which teachers (and other adults) transmit values to pupils. Others see
it as an activity that can take place in any organization during which people are assisted by others, who may be older, in a position of authority or are more experienced, to make explicit those values underlying their own behaviour, to assess the effectiveness of these values and associated behaviour for their own and others' long term well-being and to reflect on and acquire other values and behaviour which they recognize as being more effective for long term wellbeing of self and others. This means that values education can take place at home, as well as in schools, colleges, universities, offender institutions and voluntary youth organizations. There are two main approaches to values education. Some see it as inculcating or transmitting a set of values which often come from societal or religious rules or cultural ethics. Others see it as a type of Socratic dialogue where people are gradually brought to their own realization of what is good behaving or for themselves and their community. Value education also leads to success. It has values of hard work, how nobody is useless and loving studies.

Explicit values education is associated with those different pedagogies, methods or programmes that teachers or educators use in order to create learning experiences for students when it comes to value questions. Implicit values education on the other hand covers those aspects of the educational experience resulting in value influence learning, which can be related to the concept of hidden curriculum. This discussion on implicit and explicit raises the philosophical problem of whether or not an unintentional action can be called education.

The objectives are:
a. To improve the integral growth of human begins.
b. To create attitudes and improvement towards sustainable lifestyle.
c. To increase awareness about our national history our cultural heritage, constitutional rights, national integration, community development and environment.
d. To create and develop awareness about the values and their significance and role.
e. To know about various living and non-living organisms and their interaction with environment.
f. Value Based Environmental Education:

Let us see how environmental education be made value-oriented:

## 1. Human Values

Preparation of text-books and resource materials about environmental education can play an important role in building positive attitudes about environment. The basic human value ' man in nature' rather than 'nature for man' needs to be infused through the same.

## 2. Social Values

Love, compassion, tolerance and justice which are the basic teachings of most of our religions need to be woven into environmental education. These are the values to be nurtured so that all forms of life and the biodiversity on this earth are protected.

## 3. Cultural and Religious Values

These are the values enshrined in Vedas like 'Dehi me dadami te' i.e. "you give me and 1 give you" (Yajurveda) emphasize that man should not exploit nature without nurturing her. Our cultural customs and rituals in many ways teach us to perform such functions as would protect and nurture nature and respect every aspect of nature, treating them as sacred, are it rivers, earth, mountains or forests.

## 4. Ethical Values

Environmental education should encompass the ethical values of earth-centric rather than human-centric world-view. The educational system should promote the earth-citizenship thinking. Instead of considering human being as supreme we have to think of the welfare of the earth.

## 5. Global Values

The concept that the human civilization is a part of the planet as a whole and similarly nature and various natural phenomena over the earth are interconnected and inter-linked with special bonds of harmony. If we disturb this harmony anywhere there will be an ecological imbalance leading to catastrophic results.

## 6. Spiritual Values

Principles of self-restraint, self-discipline, contentment, reduction of wants, freedom from greed and austerity are some of the finest elements intricately woven into the traditional and religious fabric of our country. All these values promote conservationism and transform our consumerist approach.

## Conclusion

From the above discussion it can be said that value can't be teach but should be used in daily life with other teachers, principal's behaviour and work. It is difficult to give value. It is gain through good habit. Education and value is link with other. Education is the necklace and value is its pearl that always move,
through education, value can be gain.
Education is sweet Fruit, than value is its juice
Education is lamp, than value is its light
Education is Instrument, than value is Medium
Education is Activity, than value is result.

