

PROJECT COMPLETION REPORT

File No.: EMR/2017/003092

1. Title of the project: Study of the Abundance and Characteristics of Interstellar Dust
2. Principal Investigator: Dr. Rupjyoti Gogoi, Department of Physics, Tezpur University, Napaam, India
Co-Investigator: Prof. Amit Pathak, Department of Physics, Banaras Hindu University, UP, India
3. Implementing Institution(s): Tezpur University
4. Date of commencement: 27-06-2018
5. Planned date of completion: 27-05-2021
6. Actual date of completion: 27-05-2021
7. Objectives as stated in the project proposal:
 - (i) To study the dust distribution in the Milky Way (MW) using correlation techniques.
 - (ii) To study the dust distribution and properties in nearby galaxies such as the Large Magellanic Cloud (LMC) and Small Magellanic Cloud (SMC) in comparison to Milky Way.
 - (iii) To estimate the dust optical constants (albedo, asymmetry factor, extinction) in different regions of our sample (MW, LMC and SMC).
 - (iv) To model interstellar dust properties using both Effective Medium Approximation (EMA) and Discrete Dipole Approximation (DDA) techniques.
8. Deviation made from original objectives if any, while implementing the project and reasons thereof: NA
9. Experimental work giving full details of experimental set up, methods adopted, data collected supported by necessary table, charts, diagrams & photographs:

As mentioned in one of the objectives, we have studied the diffuse dust emission in the Small Magellanic Cloud (SMC). The difference in the extinction curve of the SMC with respect to that of the Milky Way (MW) and the Large Magellanic Cloud (LMC) has been a subject of interest over many years. We tried to study correlations between infrared (IR) and far-ultraviolet (FUV) bands for few locations in the SMC. For far-ultraviolet (FUV: 1000–1750 Å⁰), we have used observations made by the Far Ultraviolet Spectroscopic Explorer (FUSE) and the International Ultraviolet Explorer (IUE) telescopes. We have compared these FUV diffuse emissions with mid-infrared (MIR) and far-infrared (FIR) observations made by the Spitzer Space Telescope (SST) for the same locations. We tried to study and explain the dust component responsible for the observed emission properties through these correlation studies.

We have computed Spearman's rank correlation coefficients among the FUV and infrared (IR) intensities to study the relation between them. In our studies till date, we have found significant correlation among the MIR and FUV intensities. A good 8 micron versus FUV correlations obtained in our study is interesting since it indicates the presence of Polycyclic Aromatic Hydrocarbons (PAHs). A good correlation between 24 micron emission and FUV may indicate the presence of Very Small Grains (VSGs). Since the weakness or absence of the 2175 Å⁰ feature in the SMC extinction curve is associated with the absence of PAH molecules, we have explained the selective presence of this feature in the SMC using our observed correlation trends.



In one of our earlier works (Saikia et. al. 2016), we presented the correlation studies for 30 Doradus region (also known as Tarantula Nebula), an HII region in the Large Magellanic Cloud (LMC). We are now trying to model the same. 30 Doradus is an active star forming region in the LMC and is one of the largest HII region in the local group. We have taken the observed data from Pradhan et al. (2010) who reported first FUV diffuse emission from different parts of the Large Magellanic Cloud using observations made by Far Ultraviolet Spectroscopic Explorer (FUSE) telescope. They reported FUV diffuse emission from 81 different locations in LMC, out of which we found 10 locations to lie within the 30 Doradus region. The FUV emission from these locations was reported in seven wavelength bands with effective wavelengths at 1004 Å⁰, 1058 Å⁰, 1117 Å⁰, 1157 Å⁰, 1159 Å⁰, 1112 Å⁰ and 1056 Å⁰. We have chosen wavelength of 1157 Å⁰ for our work, the reason being the non-availability of stellar UV data for the other wavelengths.

Since 30 Doradus is a star burst region, we have selected few hot O and B type stars within one degree radius from the central region of it. We have used the data from MAST International Ultraviolet Explorer to calculate the UV flux of the stars. The distances and spectral types of the stars have been obtained from SIMBAD Astronomical Database. We have tried to model our region using single and multiple scattering techniques.

The FUV models:

i) Single scattering model: The Single Scattering model by Shalima et al. (2006) is used to model a region where single scattering prevails and hence we try to find out the best fitted values for albedo (α) and the asymmetry factor (g). This model uses the Henyey- Greenstein scattering phase function (Henyey and Greenstein 1941),

$$\phi(\theta) = \frac{(1 - g^2)}{4\pi[1 + g^2 - 2g\cos(\theta)]^{\frac{3}{2}}} \dots\dots\dots(1)$$

where g is the phase function asymmetry factor and θ is the angle of scattering. If g is close to 0, it implies an isotropic scattering and if g is close to 1, it implies a strong forward scattering. As an output, this model gives the expected flux at the dust locations for each combination of α and g . We then compare the expected fluxes with the observed fluxes at the corresponding dust locations and find out the best fit parameters by performing the Chi-square minimization test.

ii) Multiple scattering model: The Multiple scattering model by Shalima and Murthy (2004) is used to calculate the FUV scattered intensity from a region where multiple scattering prevails. This is a Monte Carlo based model which simulates the scattered emission from a star in arbitrary scattering geometry. Each photon is emitted from a star in random direction and continues to travel in that direction until an interaction occurs. After interaction, the photon's direction changes, and the new direction is given by Henyey- Greenstein scattering phase function [equation (1)]. The output from this model is obtained as FITS images, on which we perform aperture photometry on our dust locations to obtain the expected flux. Then we compare our obtained flux values with the observed flux values to find out the best fit values of α and g at our dust locations.

One constraint we have in this project is the need of both UV and IR data corresponding to same locations. Though we plan to do these for Magellanic Clouds, we came across AstroSat data for Holmberg II. Holmberg II is an irregular gas rich dwarf galaxy in the group M81-NGC 2403, at a distance of ~3.4 Mpc. One of the distinguishing feature of Holmberg II is that it contains an ultra luminous X-ray source (ULX) Holmberg II X-1 ($L_x > 10^{40}$ ergs/cm²/s). Because of its similarity with LMC and SMC, we targeted to study the correlations between FUV and MIR and then to find a suitable model to estimate various dust optical constants. We will see if the same model can explain certain regions of LMC and SMC. With an aim to model ULX source Holmberg II X-1, we first study the UV flux from the source using AstroSat observation (Proposal ID: A07_054, PI: Margarita

Safonova). Determination of UV flux together with information about MIR intensity will help us in estimation of dust optical parameters (albedo, asymmetry factor etc.) for the region.

Holmberg II is a highly ionised nebula with diffuse He II emission (4686 \AA^0). Lau et al. (2017) observed MIR variability from the ULX source Holmberg II X-1 and attributed this MIR emission from a circumbinary torus of dust and the variability in MIR flux to increased dust temperature. We, therefore, plan to derive conclusively the characteristics of the dust in the region through dust modelling both in UV and IR. Imaging observations of Ho-II X-1, used in this study were obtained with AstroSat in 3 epochs during 2016 and 6 epochs during 2019-2020 observing cycle. Ho-II X-1 was observed with UVIT as primary instrument (in FUV and NUV channels) and X-ray telescopes (SXT and LAXPC) as secondary instruments.

These Level 1 data files were processed using JUDE (Jayant's UVIT Data Explorer) pipeline into Level 2 data products, suitable for scientific analysis. We get photon lists and images of the sky as output files. When the processing is done, aperture photometry is performed thereafter on these images to get the required UV flux. The primary Level 2 data product from JUDE is a UV photon list for every exposure and stored in a FITS binary table. These individual photon events from Level 2 UV files are added to form an image of the sky. First, the individual Level 1 data files in different orbits are processed with JUDE in automatic mode (with the help of a routine *process_uvut.com* inside JUDE). This produces photon lists and images of the sky for every exposure, both in FUV and NUV channels (Level 2 output files). To improve the quality of the images, we reprocess the photon lists and images interactively, using another routine *interactive.com*. With proper image registration, we have been able to attain a resolution of $\sim 1.5''$. After the image processing is done, we performed astrometric calibration on each of the images. Finally, all the astrometrically corrected images in different orbits are co-added to form a single co added image in each of the channels. Aperture photometry was performed on these co added images in both channels separately, where the flux was measured in a 5 pixel radius aperture centred on the ULX source (RA = 08 h 18m 29.81s, Dec = $70^{\circ} 42' 18.2''$). Sky and nebular background were measured within an annulus from 7 to 12 pixels surrounding the source and subtracted from the total flux. Results are presented in Table 1:

Date	Band	CPS (cnt/sec)	CPS-b/g (cnt/sec)	Flux (ergs/cm ² /s/A)	Flux error (ergs/cm ² /s/A)	Total time (sec)
Sep 2016	FUV F1	0.004	0.003985	1.54176e-17	2.4379e-18	10036.65
	NUV F6	0.0234	0.02329	6.5178e-17	4.2328e-18	10181.54
Nov 2016	FUV F2	0.0825	0.08233	3.46082e-16	1.2596e-17	9169.86
	NUV F3	0.122	0.12179	1.25773e-16	4.1353e-18	7595.424
Dec 2016	FUV F2	0.143188	0.14058	5.9648e-16	1.6554e-17	9149.31
	NUV F3	0.0144	0.014256	6.0191e-17	5.386e-18	8722.07
16 Dec 2019	FUV F1	0.174533	0.17370	6.720e-16	1.167e-17	17331.68
20 Dec 2019	FUV F1	0.203222	0.20237	7.829e-16	1.329e-17	17124.54
2 Jan 2020	FUV F1	0.163536	0.16263	6.291e-16	1.205e-17	16748.53
7 Feb 2020	FUV F1	0.103982	0.10311	3.989e-16	0.9598e-17	16750.48
15 Feb 2020	FUV F1	0.108309	0.10750	4.159e-16	0.9715e-17	17048.38

Table 1: Estimated UV fluxes from Ho-II X-1

The co added images for NUV and FUV channels for the December 2016 are shown in Figure 1 and 2.



Figure 1: NUV co-added image for Ho-II X-1 (December 2016)

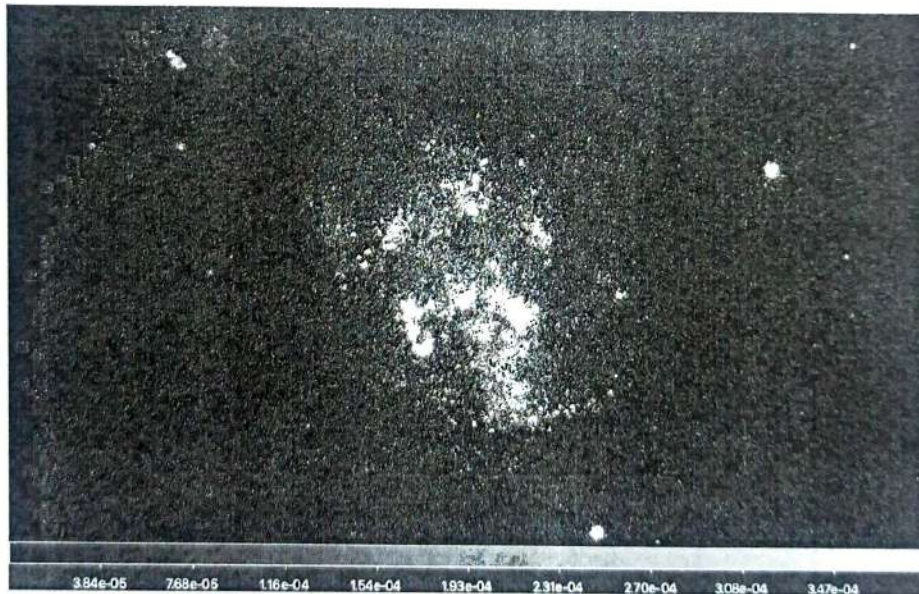


Figure 2: FUV co-added image for Ho-II X-1 (December 2016)

With an aim to understand grain properties through correlation studies, we try to find the correlations between diffuse FUV and IR emissions from Holmberg II. We have selected 50 different locations throughout the galaxy for our study. These locations lie in the vicinity of different HII regions in the galaxy. The FUV imaging observations of Holmberg II were obtained with the UVIT instrument, as mentioned above. The Infrared (IR) observations of the galaxy were taken from the archive of Spitzer Space Telescope, in 7 wavelengths: 3.6 μm , 4.5 μm , 5.8 μm , 8 μm , 24 μm , 70 μm and 160 μm .

As mentioned earlier, we processed the Level 1 data from UVIT with the help of a specially written pipeline JUDE (Murthy et al., 2017), which extracts photon events, corrects for the spacecraft motion known as image registration and then adds into an image. As the output of the image processing, we get photon event list and images of the sky (Level 2 data). But sometimes, in the automatic mode, the image registration is not so good. For that, we reprocess the Level 2 data in the manual mode, so that we can have a proper image registration. One can achieve a spatial resolution of 1.2"-1.6" in the UV bands with proper image registration (Rahna et al., 2017).

After the image processing, the individual images are calibrated astrometrically in order to place them on a common reference frame and then finally co-added, on which photometry of our observed locations was performed. The fluxes obtained from the final image are in the units of counts/second (CPS). These fluxes are then converted into physical flux units of $\text{ergs}/\text{s}/\text{cm}^2/\text{\AA}$ by multiplying with the conversion factors C for appropriate filters. The flux errors are calculated by dividing the square root of the CPS by the total exposure time and then multiplying by the respective conversion factors.

UVIT flux calibration was performed using some standard stars like HZ4, LB227 and some other bright stars which were also observed by GALEX and then used to find the conversion factors from CPS to flux, mentioned in Table 1. The reason behind tying up the UVIT calibration with GALEX calibration was the assumption that the individual stars will have the same relative response (Rahna et al., 2017).



Figure 3: FUV processed and co-added image from AstroSat

For IR, we have considered the Post Basic Calibrated Data (pbcD) from the Spitzer Heritage Archive in this work. These pbcD images are then corrected for stellar contamination. Assuming the $3.6 \mu\text{m}$ emission as stellar emission, we have scaled the $3.6 \mu\text{m}$ image by 0.596, 0.399, 0.232 and 0.032 for $4.5 \mu\text{m}$, $5.8 \mu\text{m}$, $8 \mu\text{m}$ and $24 \mu\text{m}$ respectively and then subtracted from the original images pixel by pixel to get the dust emission (Helou et al., 2004). The stellar contributions at $70 \mu\text{m}$ and $160 \mu\text{m}$ are neglected because it decreases sharply with the increase in wavelength. The infrared intensities ($I_{4.5}$, $I_{5.8}$, I_8 , I_{24} , I_{70} , I_{160}) are in the units of MJy sr^{-1} .

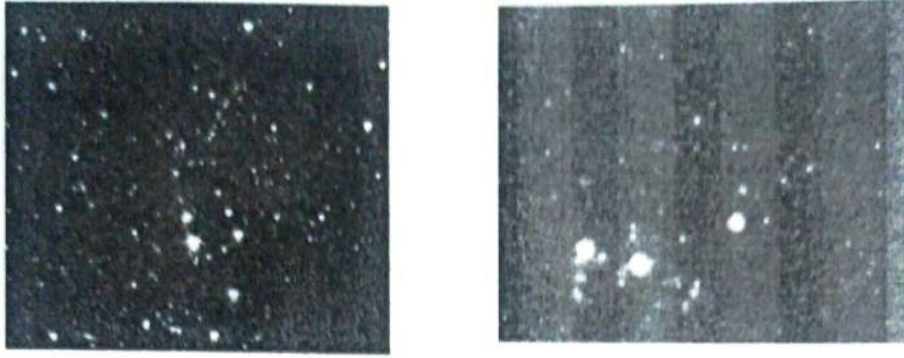


Figure 4: 3.6 μm (left) and 24 μm (right) IR images from Spitzer Space Telescope

On obtaining the fluxes, we have found the rank correlation between the FUV and the IR intensity values for six wavelengths that we have observed. Rank correlation is an important statistical tool that signifies the relation between two quantities. Since we have assumed the 3.6 μm emission as stellar emission during the stellar contamination correction, so we have not used the 3.6 μm emission for our correlation study. The rank correlation coefficient lies in the interval $[-1, 1]$. Higher value of rank correlation coefficient implies a better correlation between the two quantities. The coefficient value of 1 implies a perfect agreement between the rankings, 0 implies the rankings are completely independent and -1 implies a perfect disagreement or one ranking is the reverse of the other.

We have used the Spearman's rank correlation coefficient (ρ). For a sample size of n , the n raw scores X_i, Y_i are converted into ranks x_i, y_i and then ρ is calculated as:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2 - 1)}$$

where, $d_i = x_i - y_i$ is the difference between the ranks.

The probability or p-value is a measure of how likely an observed correlation is due to chance. p-value lies between 0 and 1. A p-value close to 1 suggests no correlation other than due to chance and one must accept the null hypothesis. p-value close to 0 signifies the correlation is unlikely to be due to chance and there is a high probability that the null hypothesis is wrong. So one must accept the alternative hypothesis that a correlation exists between the two quantities.

10. Detailed analysis of results indicating contributions made towards increasing the state of knowledge in the subject:

The prime motivation of our study is to propose dust models to understand grain properties in various available samples. For preliminary understanding of the dust grains in a sample, we do a correlation study of UV and IR, for which we need simultaneous UV and IR observation for the selected sample. We have done a correlation study for few locations in Small Magellanic Cloud, which will be followed by proposing a model to estimate dust optical constants. We have studied the IR-FUV correlations for 20 diffuse locations in the SMC and we find both the MIR (8 & 24 μm) and FIR (70 μm) dust emissions to be very well correlated to the FUV emissions at the observed locations. Since the weakness or absence of the 2175 \AA feature in the SMC extinction curve is associated with the absence of PAH molecules, we have attempted to explain the selective presence of this feature in the SMC using our observed correlation trends.

Also, we tried to propose a dust model for 30 Doradus region of Large Magellanic Cloud. To model the 30 Doradus region/Farantula Nebula in the LMC, we have taken the observed data from Pradhan et al. (2010), which were estimated by using observations made by Far Ultraviolet

Spectroscopic Explorer (FUSE) telescope. The IR data was taken from Spitzer Space Telescope. After studying the correlation trends, we have tried to model the region. We have calculated the scattering optical depths for different available dust locations to find the best fit for the model intensities. The model agrees with the observed values for a dust model with moderately thick optical depth, as suggested by the estimated scattering optical depth values. This indicates that scattering is happening at the outer layers of the dust clouds, while the absorption and re-emission part of the extinction process is happening at a much deeper layer of the dust distribution. The observed range of scattering optical depths indicates that the dust geometry is not simple or homogeneous but rather exhibits variations and complexities across different locations within the HII region. The scattering optical depth depends on various factors, such as dust density, distribution, and particle size. The results also suggest that the 30-Doradus HII region has a moderate amount of dust, which is neither too optically thin nor too optically thick.

Because of the similarity of Holmberg II, with the Magellanic Clouds, and the availability of AstroSat data for Holmberg II, we studied the correlations between FUV and MIR and then to find a suitable model to estimate various dust optical constants. We determine UV flux from an Ultra Luminous X-ray source (ULX) Holmberg II X-1 using AstroSat observation, as mentioned already. We tried to correlate these estimated flux values with MIR flux values, which will enable us to understand dust properties in the sample.

The estimated correlation coefficient show that the FUV~IR correlation is best for 24 μm and 70 μm . The 24 μm and 70 μm emission are known to be warm dust tracer, which are being emitted by the VSGs (Very Small Grain) heated by the hot stars nearby. Since our locations are close to different HII regions, our observed correlations are quite in agreement as there will be hot, young stars in the HII regions. The UV emission from the hot stars in the nearby HII regions results into heating the dust grains to produce the MIR emissions, rather than cold dust emission. We do not find a good FUV~IR correlation for 8 μm , which indicates that the PAH emission in this galaxy is very weak. It may be possible that the PAH molecules have been destroyed at such temperatures.

We have also attempted the dust modelling of Holmberg II. We have obtained the values of albedo and asymmetry factor at selected locations, which is less than theoretically predicted value for LMC. In our findings, we have seen that dust grains which are forward scattering and have high albedo values are primarily associated with the star forming complexes. Our finding also hints that a low value of optical depth for the layer responsible for scattering of radiation by the dust grains. This confirms the fact that diffuse UV emission originates from scattering by optically thin clouds.

References:

- Saikia, G., Shalima, P., Gogoi, R. and Pathak, A., Comparison of diffuse infrared and far-ultraviolet emission in the Large Magellanic Cloud: The data, *Planetary and Space Science*, volume 133, p. 90, 2016.
- Pradhan, A. C., Pathak, A., and Murthy, J. Far-ultraviolet diffuse emission from the Large Magellanic Cloud, *The Astrophysical Journal Letters*, Volume 718(2), page L141, 2010.
- Shalima, P., Sujatha, N. V., Murthy, J., Henry, R. C., and Sahnou, D. J., Far-ultraviolet scattering by dust in Orion, *Monthly Notices of the Royal Astronomical Society*, volume 367, page 1686, 2006.
- Henry, L. G. and Greenstein, J. L., Diffuse radiation in the Galaxy, *The Astrophysical Journal*, volume 93, page 70, 1941.

Shalima, P., Murthy, Jayant, Modelling of dust scattering toward the Coalsack, Monthly Notices of the Royal Astronomical Society, volume 352, Issue 4, page 1319, 2004.

Lau, R. M., Heida, M., Kasliwal, M. M. and Walton, D. J., First Detection of Mid-infrared Variability from an Ultraluminous X-Ray Source Holmberg II X-1. *ApJL*, 838:L17, 2017.

Murthy, J., Rahna, P.T., Sutaria, F., Safonova, M. et al., JUDE: an alternative UVIT pipeline, *Astronomy and Computing*, 20:120. doi:10.106/j.ascom.2017.07.001, 2017.

Rahna P., Murthy J., Safonova M., Sutaria F., Gudennavar S., Bubbly S., Monthly Notices of the Royal Astronomical Society, volume 471, page 3028, 2017.

11. Conclusions summarizing the achievements and indication of scope for future work:

The attempted dust models will explain nature and properties of dust in selected samples. It will be helpful for better understanding of interstellar dust in the universe as these can be extended to other samples as well, with best fit parameters for the target. The project fellow will submit the thesis after satisfactory completion of the results and analysis part. So, one PhD student will be produced in this project work. We have published one paper and will be submitting two other papers soon.

12. S&T benefits accrued:

i. List of Research publications

Sl. No	Authors	Title of the paper	Name of the journal	Volume	Pages	Year
1.	A Vinokurov, K Atapin, OP Bordoloi, A Sarkisyan, U Kashyap, M Chakraborty, PT Rahna, A Kostenkov, Y Solovyeva, S Fabrika, M Safonova, R Gogoi, F Sutaria, J Murthy	Simultaneous X-ray/UV observations of ultraluminous X-ray source Holmberg II X-1 with Indian space mission AstroSat	Astrophysical Bulletin	77	231-245	2022
2.	Olag Pratim Bordoloi, M. Safonova, B. Ananthamoorthy, P. Shalima, Rupjyoti Gogoi, Debbijoy Bhattacharya and Yuri A. Shechekinov	AstroSat/UVIT study of the Diffuse Far Ultraviolet Radiation in Dwarf Galaxy Holmberg II	To be submitted to MNRAS			
3.	Barenya Kumar Dev, Olag Pratim Bordoloi, P. Shalima, Gautam Saikia, Rupjyoti Gogoi	Accounting For the Diffuse Dust Emission from the Large Magellanic Cloud	Manuscript under preparation			

ii. Manpower trained on the project: 1

a) Research Scientists or Research Associates: Nil

b) No. of Ph.D. produced: 1 (ongoing)

c) Other Technical Personnel trained: Nil

iii. Patents taken, if any: Nil

13. Financial Position:

No	Financial Position/ Budget Head	Funds Sanctioned	Expenditure	% of Total cost
I	Salaries/ Manpower costs	1029600	937806	63.25
II	Equipment	457275	246645	16.63
III	Supplies & Materials			
IV	Contingencies	150000	141519	9.54
V	Travel	150000	44910	3.03
VI	Overhead Expenses	178687	111675	7.53
VII	Others, if any			
	Total	1965562	1482555	100%

14. Procurement/ Usage of Equipment

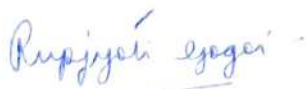
a)

S No.	Name of equipment	Make/Model	Cost (FE/Rs)	Date of installation	Utilization rate (%)	Remarks regarding maintenance
1.	Workstation	DELL Precision 5820 Tower	Rs. 2,24,070/-	28-01-2019	100%	
2.	Printer	HP LaserJet Pro M403n	Rs. 22,575/-	28-12-2018	100%	

b) Plans for utilizing the equipment facilities in future:

The equipment will be used by research scholars and masters students, who are working on future scope of this project work.

Name and Signature with Date:



(Dr Rupjyoti Gogoi)

Annexure-II

REQUEST FOR ANNUAL INSTALMENT WITH UP-TO-DATE STATEMENT OF EXPENDITURE

1. SERB Sanction Order No. and date : **EMR/2017/003092** dated **04.06.2018**
2. Name of the PI : Dr. Rupjyoti Gogoi
3. Total project Cost : Rs. 19,65,562/-
4. Revised Project Cost (if applicable) : NA
5. Date of Commencement : 27-06-2018
6. Statement of Expenditure :

(Month wise expenditure incurred during current financial year, 2018-2019)

Month and Year	Expenditure incurred
August, 2018	Rs. 806/-
September, 2018	Rs. 25,000/-
October, 2018	Rs. 78,887/-
November, 2018	Rs. 25,000/-
December, 2018	Rs. 38,833/-
January, 2019	Rs. 25,000/-
February, 2019	Rs. 2,71,645/-
March, 2019	Rs. 75,293/-
Total	Rs. 5,40,464/-

1. Grant received in each year:
 - a. 1st Year : **Rs. 9,60,037/-**
[Rs. 4,57,275/- (Non- Recurring) + Rs. 5,02,762/- (Recurring)]
 - b. 2nd Year : NA
 - c. 3rd Year : NA
 - d. Interest, if any : **Rs. 6,932/-**
 - e. Total (a+b+c+d) : **Rs. 9,66,969/-**

OK 2018-19

Statement of Expenditure

(27.06.2018-31.03.2019)

Sr No	Sanctioned Heads (II)	Total Funds Allocated (indicate sanctioned or revised) (III)	Expenditure Incurred			Total Expenditure till 31.03.2019 (VII = IV + V + VI)	Balance as on (31.03.2019) (VIII = III - VII)	Requirement of Funds upto 31.03.2020	Remarks (if any)
			1 st Year (27.06.2018-31.03.2019) (IV)	2 nd Year (1 st April to 31 st March next year) (V)	3 rd Year & so on (1 st April to 31 st March next year) (VI)				
1.	Manpower costs		1,75,806/-	NA	NA	1,75,806/-	2,08,943/- ^①	3,90,000/- ^②	^① The amount includes fellowship at revised rate (Rs. 31,000/- pm) from April 2019- March 2020 along with the arrears (@ 6,000/- pm) from January 2019- March 2019 (6000/- x 3 = 18,000/-)
2.	Consumables		NA	NA	NA	NA	NA	NA	
3.	Travel	5,02,762/-	31,129/-	NA	NA	31,129/-	^③ = 5,02,762- (1,75,806 + 31,129 + 49,659 + 37,225)	1,00,000/-	
4.	Contingencies		49,659/-	NA	NA	49,659/-			
5.	Others, if any		NIL	NA	NA	NIL			
6.	Overhead expenses		37,225/-	NA	NA	37,225/-		59,562/-	
7.	Equipment	4,57,275/-	2,46,645/-	NA	NA	2,46,645/-	2,10,630/-	NA	
8.	Bank interest	6,932/- (for 1 st year)	NA	NA	NA	NA	6,932/-	NA	Rs. 3,90,000 = [(31,000 x 12) + 18,000] (Arrears)
9.	Total	9,66,969/- (with bank interest)	5,40,464/-	NA	NA	5,40,464/-	4,26,505/- (with bank interest)	5,49,562/-	

Rupjyoti Jyoti
(DR RUPJYOTI GOGOI)

Name and Signature of Principal Investigator:

Date: 08/05/2019

Rupjyoti Jyoti
(with Seal) **Finance Officer**

Signature of Competent financial authority: _____

Date: _____

Note : * DOS - Date of Start of project

1. Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB i.e. Figures in Column (VIII) should not exceed corresponding figures in Column (III)
2. Utilisation Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry-forward permission to the next financial year.

GFR 12 – A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2018-19
in respect of NON- RECURRING
as on 31.03.2019 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator (PI) : Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date : **EMR/2017/003092** dated **04-06-2018**
4. Title of the Project : **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : Non-Recurring
7. Grants position at the beginning of the Financial year (Grants released by SERB)
 - (i) Cash In Hand/Bank /Carry forward from previous financial year : **Rs. 4,57,275/-**
 - (ii) Others, If any : **NIL**
 - (iii) **Total** : **Rs. 4,57,275/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years [figure as at Sl. No. 7(m)]	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year 2018-19			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			1	2	3			
NA	NA	NA	Sanction No. (i)	Date (ii)	Amount (iii)			
			EMR/2017/003092	04/06/2018	Rs. 4,57,275/-	Rs. 4,57,275/-	Rs. 2,46,645/-	Rs. 2,10,630/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
	1. Workstation: Rs. 2,24,070/- 2. Printer :Rs. 22,575/-	Rs. 2,46,645/-

Details of grants position at the end of the year

- (i) Cash in Hand/Bank : Rs. 2,10,630/-
- (ii) Refunds to SERB, If any : NIL
- (iii) Balance (Carry forward to next financial year) : Rs. 2,10,630/-

02/2018-19

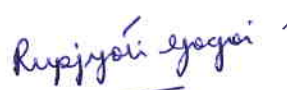


GFR 12 – A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2018-19
in respect of NON-RECURRING
as on 31.03.2019 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under **EMR** (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date: 08/05/2019

Place: Tezpur

 Signature of PI :	 Signature with Seal Name: Finance Officer Chief Finance Officer (Tezpur University)	 Signature with Seal Name: Reg. Officer Tezpur University Head of Organisation
--	---	---

GFR 12 – A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2018-19
in respect of RECURRING
as on 31.03.2019 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator (PI) : Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date : **EMR/2017/003092** dated **04-06-2018**
4. Title of the Project : **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : **Recurring**
7. Grants position at the beginning of the Financial year (Grants released by SERB)
 - (i) Cash In Hand/Bank /Carry forward from previous financial year : **Rs. 5,02,762/-**
 - (ii) Others, If any : **NIL**
 - (iii) **Total** : **Rs. 5,02,762/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years [figure as at Sl. No. 7(iii)]	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year 2018-19			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			1	2	3			
NA	6,932/-	NA	Sanction No. (i)	Date (ii)	Amount (iii)			
			EMR/2017/003092	04/06/2018	Rs. 5,02,762/-	Rs. 5,09,694/-	Rs. 2,93,819/-	Rs. 2,15,875/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
1. Manpower costs : Rs. 1,75,806/-		Rs. 2,93,819/-
2. Travel : Rs. 31,129/-		
3. Contingency : Rs. 49,659/-		
4. Overhead expenses : Rs. 37,225/-		

Details of grants position at the end of the year

- (i) Cash in Hand/Bank : **Rs. 2,15,875/-**
- (ii) Refunds to SERB, If any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 2,15,875/-**




2015-149

GFR 12 – A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2018-19
in respect of RECURRING
as on 31.03.2019 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under **EMR** (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date: 08/05/2019
Place: Tezpur.

 Signature of PI :	 Signature with Seal : Name: Finance Officer Chief Finance Officer (Head of Finance) Tezpur University	 Signature with Seal..... Name: Registrar Tezpur University Head of Organisation
--	---	--

(Strike out inapplicable terms)

Annexure-II

REQUEST FOR ANNUAL INSTALMENT WITH UP-TO-DATE STATEMENT OF EXPENDITURE

1. SERB Sanction Order No. and date : **EMR/2017/003092** dated **04.06.2018**
2. Name of the PI : Dr. Rupjyoti Gogoi
3. Total Project Cost : Rs. 19,65,562/-
4. Revised Project Cost (if applicable) : NA
5. Date of Commencement : 27-06-2018
6. Statement of Expenditure :
(Month wise expenditure incurred during current financial year, 2019-20)

Month and Year	Expenditure incurred/committed
April, 2019	Rs. 49,000/-
May, 2019	Rs. 31,000/-
June, 2019	Rs. 31,000/-
July, 2019	Rs. 31,000/-
August, 2019	Rs. 31,000/-
September, 2019	Rs. 31,000/-
October, 2019	Rs. 31,000/-
November, 2019	Rs. 31,000/-
December, 2019	Rs. 44,781/-
January, 2020	Rs. 31,000/-
February, 2020	Rs. 75,041/-
March, 2020	Rs. 73,619/-
Total	Rs. 4,90,441/-

1. Grant received in each year:
 - a. 1st year : **Rs. 9,60,037/-**
[Rs. 5,02,762/- (Recurring) +
Rs. 4,57,275/- (Non- Recurring)]
 - b. 2nd year : **Rs. 4,00,000/-** [Recurring]
 - c. 3rd year : NA
 - d. Interest, if any : Rs. 6932/- (1st year) + Rs. 5587 (2nd year)
= **Rs. 12,519/-**
 - e. Total (a + b + c + d) : **Rs. 13,72,556/-**

Statement of Expenditure
(to be submitted financial year wise i.e. 27.06.2018 to 31.03.2019, 01.04.2019 to 31.03.2020)

Sr No	Sanctioned Heads	Total Funds Allocated (indicate sanctioned or revised) (III)	Expenditure incurred			Total expenditure till 31.03.2020 (VII=IV+V+VI)	Balance as on 31.03.2020 (VIII= III-VII)	Requirement of funds up to 31 st March, 2021	Remarks (if any)
			1 st year (27.06.2018 – 31.03.2019) (IV)	2 nd year (01.04.2019 – 31.03.2020) (V)	3 rd year (VI)				
(I)	(II)								
1	Manpower costs	5,02,762/- (1 st year) + 4,00,000/- (2 nd year) = 9,02,762/-	1,75,806/-	3,90,000/-	NA	5,65,806/-	1,18,502/-	4,20,000/-	
2	Consumables		NA	NA	NA			NA	
3	Travel		31,129/-	13,781/-	NA	44,910/-		1,00,000/-	
4	Contingencies		49,659/-	49,435/-	NA	99,094/-			
5	Others, if any		NIL	NIL	NA				
6	Overhead expenses		37,225/-	37,225/-	NA	74,450/-		59,562/-	
7	Equipment	4,57,275/-	2,46,645/-	NIL	2,46,645/-	2,10,630/-	NA		
8	Bank interest	6932/- (for 1 st year) + 5587 (for 2 nd year)	NA	NA	NA	6932 + 5587 =12,519	NA		
9	Total	13,72,556/- (with bank interest)	5,40,464/-	4,90,441/-	NA	10,30,905/-	3,41,651/- (with bank interest)	5,79,562/-	

Rupjyoti Gogoi
(DR RUPJYOTI GOGOI)

Name and signature of principal Investigator:

Date:

Signature of competent financial authority:

(with seal) **Finance Officer**

Date: **Tezpur University**

*DOS- Date of start of project

Note:

- Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB, i.e. Figures in column (VIII) should not exceed corresponding figures in column (III).
- Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry forward permission to the next financial year.

GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2019-20
in respect of NON-RECURRING
as on 31.03.2020 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator(PI): Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date: **EMR/2017/003092** dated **04.06.2018**
4. Title of the Project: **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : **Non-Recurring**
7. Grants position at the beginning of the Financial year
 - (i) Cash in Hand/Bank/Carry forward from previous financial year : **Rs. 2,10,630/-**
 - (ii) Other, if any : **NIL**
 - (iii) **Total** : **Rs. 2,10,630/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received Previous years [figure as at Sl No. 7(iii)]	Interest Earned thereon	Interest Deposited Back to the SERB	Grants received during the year 2019-20			Total Available Funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
Rs. 2,10,630/-	NIL	NA	EMR/2017/003092	18.09.2019	Rs. 0.00	Rs. 2,10,630/-	Rs. 0.00	Rs. 2,10,630/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
	NA	NA

Details of grants position at the end of the year

- (i) Cash in Hand/Bank : **Rs. 2,10,630/-**
- (ii) Refund to SERB, if any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 2,10,630/-**




GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2019-20
in respect of NON-RECURRING
as on 31.03.2020 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under **EMR** (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date:

Place:

 Signature of PI :	 Signature with Seal : Name: Chief Finance Officer (Head of Finance) <i>Tezpur University</i>	 Signature with Seal : Name: Registrar (Head of Organisation) <i>Tezpur University</i>
--	---	--

GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2019-20
in respect of RECURRING
as on 31.03.2020 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator(PI): Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date: **EMR/2017/003092** dated **04.06.2018**
4. Title of the Project: **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : **Recurring**
7. Grants position at the beginning of the Financial year
 - (i) Cash in Hand/Bank/Carry forward from previous financial year : **Rs. 2,08,943/-**
 - (ii) Others, if any (Bank interest) : **Rs. 6932/-**
 - (iii) **Total** : **Rs. 2,15,875/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years [figure as at Sl No. 7(iii)]	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year 2019-20			Total Available Funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
2,15,875/-	5587/-	NIL	EMR/2017/003092	18.09.2019	4,00,000/-	6,21,462/-	4,90,441/-	1,31,021/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
1. Manpower costs. : Rs. 3,90,000/- 2. Travel. : Rs. 13, 781/- 3. Contingency. : Rs. 49,435/- 4. Overhead expenses: Rs. 37,225/-		Rs. 4,90,441/-

Details of grants position at the end of the year:

- (i) Cash in Hand/Bank : **Rs. 1,31,021/-**
- (ii) Refunds to SERB, if any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 1,31,021/-**


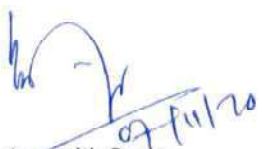

GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2019-20
in respect of RECURRING
as on 31.03.2020 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under **EMR** (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date:

Place:

 Signature of PI :	 Signature with Seal : Name: Chief Finance Officer (Head of Finance)	 Signature with Seal Name: Head of Organisation
--	---	--

Annexure-II

REQUEST FOR ANNUAL INSTALMENT WITH UP-TO-DATE STATEMENT OF EXPENDITURE

1. SERB Sanction Order No. and date : **EMR/2017/003092** dated **04.06.2018**
2. Name of the PI : **Dr. Rupjyoti Gogoi**
3. Total Project Cost : **Rs. 19,65,562/-**
4. Revised Project Cost (if applicable) : **NA**
5. Date of Commencement : **27-06-2018**
6. Statement of Expenditure :
(Month wise expenditure incurred during current financial year, 2020-21)

Month and Year	Expenditure incurred/committed
April, 2020	Rs. 31,000/-
May, 2020	Rs. 31,000/-
June, 2020	Rs. 31,000/-
July, 2020	Rs. 31,000/-
August, 2020	Rs. 31,000/-
September, 2020	Rs. 31,000/-
October, 2020	Rs. 31,000/-
November, 2020	Rs. 31,000/-
December, 2020	Rs. 31,000/-
January, 2021	Rs. 31,000/-
February, 2021	Rs. 31,000/-
March, 2021	Rs. 1,10,650/-
Total	Rs. 4,51,650/-

1. Grant received in each year:

- a. 1st year : **Rs. 9,60,037/-**
[Rs. 5,02,762/- (Recurring) + Rs. 4,57,275/- (Non-Recurring)]
- b. 2nd year : **Rs. 4,00,000/-** [Recurring]
- c. 3rd year : **Rs. 5,00,000/-** [Recurring]
- d. Interest, if any (3rd year) : **Rs. 6932/- (1st year) + Rs. 5587 (2nd year) + Rs. 3891/-**
= Rs. 16,410/-
- e. Total (a + b + c + d) : **Rs. 18,76,447/-**

Statement of Expenditure
(to be submitted financial year wise i.e. 27.06.2018 to 31.03.2019, 01.04.2019 to 31.03.2020, 01.04.2020 to 31.03.2021)

Sr No	Sanctioned Heads	Total Funds Allocated (indicate sanctioned or revised) (III)	Expenditure incurred			Total expenditure till 31.03.2021 (VII=IV+V+VI)	Balance as on 31.03.2021 (VIII= III-VII)	Requirement of funds up to 27 th June, 2021	Remarks (if any)
			1 st year (27.06.2018 – 31.03.2019) (IV)	2 nd year (01.04.2019 – 31.03. 2020) (V)	3 rd year (01.04.2020 – 31.03.2021) (VI)				
1	Manpower costs	5,02,762/- (1 st year) + 4,00,000/- (2 nd year) + 5,00,000/- (3 rd year) = 14,02,762/-	1,75,806/-	3,90,000/-	3,72,000/-	9,37,806/-	1,66,852/-	93,000/-	
2	Consumables		NA	NA	NA			NA	
3	Travel		31,129/-	13,781/-	NIL	44,910/-			
4	Contingencies		49,659/-	49,435/-	42,425/-	1,41,519/-			25,000/-
5	Others, if any		NIL	NIL	NIL				
6	Overhead expenses		37,225/-	37,225/-	37,225/-	1,11,675/-			14,890/-
7	Equipment	4,57,275/-	2,46,645/-	NIL	NIL	2,46,645/-	2,10,630/-	NA	
8	Bank interest	6932 (for 1 st year) + 5587 (for 2 nd year) + 3891 (for 3 rd year)	NA	NA	NA	NA	6932 + 5587 + 3891 =16,410/-	NA	
9	Total	18,76,447/- (with bank interest)	5,40,464/-	4,90,441/-	4,51,650/-	14,82,555/-	3,93,892/- (with bank interest)	1,32,890/-	

Rupjyoti Saha

Name and signature of principal Investigator:

Date: 17/8/21

Signature of competent financial authority:
(with seal)

Date:

Finance Officer

Tezpur University

*DOS- Date of start of project

Note:

- Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB, i.e. Figures in column (VIII) should not exceed corresponding figures in column (III).
- Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry forward permission to the next financial year.

GER 12 - A
 [(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2020-21
 in respect of **NON-RECURRING**
 as on 31.03.2021 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator(PI) : Dr. Ruppyoti Gogoi
3. SERB Sanction order no. & date : **EMR/2017/003092** dated **04.06.2018**
4. Title of the Project : **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : I MR
6. Whether recurring or non-recurring grants : **Non-Recurring**
7. Grants position at the beginning of the Financial year
 - (i) Cash in Hand/Bank/Carry forward from previous financial year : **Rs. 2,10,630/-**
 - (ii) Other, if any : **NIL**
 - (iii) **Total** : **Rs. 2,10,630/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received Previous years [figure as at Sl No. 7(iii)]	Interest Earned thereon	Interest Deposited Back to the SERB	Grants received during the year 2020-21			Total Available Funds (1-2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
			EMR/2017/003092	16.12.2020	Rs. 0.00	Rs. 2,12,711/-	Rs. 0.00	Rs. 2,12,711/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
	NA	NA

Details of grants position at the end of the year

- (i) Cash in Hand/Bank : **Rs. 2,12,711/-**
- (ii) Refund to SERB, if any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 2,12,711/-**

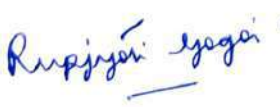


GFR12-A
 [(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2020-21
 in respect of **NON-RECURRING**
 as on **31.03.2021** to be submitted to **SERB**
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned.

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under **EMR** (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure
 – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date: 03/08/21

Place:

 Signature of PI :	 Signature with Seal : Name: Chief Finance Officer (Head of Finance)	 Signature with Seal..... Name: Head of Organisation
--	---	--

Finance Officer
Tezpur University

Registrar
Tezpur University

GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2020-21
in respect of RECURRING
as on 31.03.2021 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator(PI): Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date: EMR/2017/003092 dated 04.06.2018
4. Title of the Project: Study of the Abundance and Characteristics of Interstellar Dust
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : **Recurring**
7. Grants position at the beginning of the Financial year
 - (i) Cash in Hand/Bank/Carry forward from previous financial year : **Rs. 1,31,021/-**
 - (ii) Others, if any (Bank interest) : **NIL**
 - (iii) **Total** : **Rs. 1,31,021/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years [figure as at Sl No. 7(iii)]	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year 2020-21			Total Available Funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
			EMR/2017/003092	16.12.2020	5,00,000/-	6,32,831/-	4,51,650/-	1,81,181/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
1. Manpower costs. : Rs. 3,72,000/- 2. Travel. : NIL 3. Contingency. : Rs. 42,425/- 4. Overhead expenses : Rs. 37,225/-		Rs. 4,51,650/-

Details of grants position at the end of the year:

- (i) Cash in Hand/Bank : **Rs. 1,81,181/-**
- (ii) Refunds to SERB, if any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 1,81,181/-**




GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2020-21
in respect of RECURRING
as on 31.03.2021 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under EMR (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date:

Place:

 Signature of PI :	 Signature with Seal : Name: Chief Finance Officer (Head of Finance) <i>Finance Officer</i> <i>Tezpur University</i>	 Signature with Seal..... Name: Head of Organisation <i>Registrar</i> <i>Tezpur University</i>
--	---	--

(Strike out inapplicable terms)

Annexure-II

REQUEST FOR ANNUAL INSTALMENT WITH UP-TO-DATE STATEMENT OF EXPENDITURE

1. SERB Sanction Order No. and date :EMR/2017/003092 dated 04.06.2018
2. Name of the PI :Dr. Rupjyoti Gogoi
3. Total Project Cost : Rs. 19,65,562/-
4. Revised Project Cost (if applicable) : NA
5. Date of Commencement : 27-06-2018
6. Statement of Expenditure :
(Month wise expenditure incurred during current financial year, 2021-22)

Month and Year	Expenditure incurred/committed
April, 2021	NIL
May, 2021	NIL
June, 2021	NIL
Total	NIL

1. Grant received in each year:

- a. 1st year : **Rs. 9,60,037/-**
[Rs. 5,02,762/- (Recurring) + Rs. 4,57,275/- (Non-Recurring)]
- b. 2nd year : **Rs. 4,00,000/-** [Recurring]
- c. 3rd year : **Rs. 5,00,000/-** [Recurring]
- d. 4th year : **NIL**
(01.04.2021-26.06.2021)
- e. Interest, if any : Rs. 6932/- (1st year) + Rs. 5587/- (2nd year) + Rs. 3891/- (3rd year) + Rs. 9847/- (4th year)
= **Rs. 26,257/-**
- f. Total (a + b + c + d) : **Rs. 18,86,294/-**

Statement of Expenditure

(to be submitted financial year wise i.e. 27.06.2018 to 31.03.2019, 01.04.2019 to 31.03.2020, 01.04.2020 to 31.03.2021, 01.04.2021 to 26.06.2021)

Sr No	Sanctioned Heads	Total Funds Allocated (indicate sanctioned or revised) (III)	Expenditure incurred				Total expenditure till 26.06.2021 (VIII=IV+V+VI+VII)	Balance as on 26.06.2021 (VIII= III-VIII)	Remarks (if any)
			1 st year (27.06.2018 – 31.03.2019)	2 nd year (01.04.2019 – 31.03.2020)	3 rd year (01.04.2020 – 31.03.2021)	4 th year (01.04.2021- 26.06.2021)			
(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)			
1	Manpower costs	5,02,762/- (1 st year) +	1,75,806/-	3,90,000/-	3,72,000/-	NIL	9,37,806/-	1,66,852/-	
2	Consumables	4,00,000/- (2 nd year) +	NA	NA	NA	NA			
3	Travel	31,129/- (3 rd year) +	31,129/-	13,781/-	NIL	NIL	44,910/-		
4	Contingencies	5,00,000/- (3 rd year) + NIL (4 th year) =	49,659/-	49,435/-	42,425/-	NIL	1,41,519/-		
5	Others, if any		NIL	NIL	NIL	NIL			
6	Overhead expenses	14,02,762/-	37,225/-	37,225/-	37,225/-	NIL	1,11,675/-		
7	Equipment	4,57,275/-	2,46,645/-	NIL	NIL	NIL	2,46,645/-	2,10,630/-	
8	Bank interest	6932 (for 1 st year) + 5587 (for 2 nd year) + 3891 (for 3 rd year) + 9847 (4 th year)	NA	NA	NA	NA	NA	6932 + 5587 + 3891 + 9847 = 26,257/-	
9	Total	18,86,294/- (with bank interest)	5,40,464/-	4,90,441/-	4,51,650/-	NIL	14,82,555/-	4,03,739/- (with bank interest)	

Rupjyoti Jyoti
(DR. RUPJYOTI GOSWAMI)

Name and signature of principal Investigator:
Date:

Signature of competent financial authority
(with seal)
Date:

[Signature]
14/2/23
Finance Officer
T.our University

*DOS- Date of start of project

Note:

- Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB, i.e. Figures in column (VIII) should not exceed corresponding figures in column (III)
- Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry forward permission to the next financial year.

GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2021-22
in respect of NON-RECURRING
as on 26.06.2021 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator(PI): Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date: EMR/2017/003092 dated 04.06.2018
4. Title of the Project: **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : **Non-Recurring**
7. Grants position at the beginning of the Financial year

- (i) Cash in Hand/Bank/Carry forward from previous financial year : **Rs. 2,12,711/-**
- (ii) Other, if any : **NIL**
- (iii) **Total** : **Rs. 2,12,711/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received Previous years [figure as at Sl No. 7(iii)]	Interest Earned thereon	Interest Deposited Back to the SERB	Grants received during the year 2021-22			Total Available Funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
Rs. 2,12,711/-	5294/-	NIL	NA	NA	Rs. 0.00	Rs. 2,18,005/-	Rs. 0.00	Rs. 2,18,005/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
	NA	NA

Details of grants position at the end of the year

- (i) Cash in Hand/Bank : **Rs. 2,18,005/-**
- (ii) Refund to SERB, if any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 2,18,005/-**


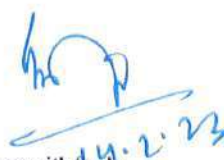

GFR12-A
 [(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2021-22
in respect of NON-RECURRING
as on 26.06.2021 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under EMR (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure
 – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date:

Place:

 Signature of PI :	 Signature with Seal: Name: Chief Finance Officer (Head of Finance)	 Signature with Seal: Name: Registrar Head of Organisation
--	--	--

Tespur University

Tespur University

GFR12-A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2021-22
in respect of RECURRING
as on 26.06.2021 to be submitted to SERB
The UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : Tezpur University, Napaam, India
2. Name of Principal Investigator(PI): Dr. Rupjyoti Gogoi
3. SERB Sanction order no. & date: EMR/2017/003092 dated 04.06.2018
4. Title of the Project: **Study of the Abundance and Characteristics of Interstellar Dust**
5. Name of the SERB Scheme : EMR
6. Whether recurring or non-recurring grants : **Recurring**
7. Grants position at the beginning of the Financial year
 - (i) Cash in Hand/Bank/Carry forward from previous financial year : **Rs. 1,81,181/-**
 - (ii) Others, if any (Bank interest) : **NIL**
 - (iii) **Total** : **Rs. 1,81,181/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years [figure as at Sl No. 7(iii)]	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year 2021-22			Total Available Funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
			NA	NA	Rs. 0.00	1,85,734/-	NIL	1,85,734/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
1. Manpower costs. : NIL		NIL
2. Travel. : NIL		
3. Contingency. : NIL		
4. Overhead expenses : NIL		

Details of grants position at the end of the year:

- (i) Cash in Hand/Bank : **Rs. 1,85,734/-**
- (ii) Refunds to SERB, if any : **NIL**
- (iii) Balance (Carry forward to next financial year) : **Rs. 1,85,734/-**




GFR12-A
 [(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2021-22
 in respect of **RECURRING**
 as on 26.06.2021 to be submitted to SERB
The UC is Audited
 (To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under EMR (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure
 – I duly enclosed.
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date:

Place:

 Signature of P.I :	 Signature with Seal Name: Chief Finance Officer (Head of Finance)	 Signature with Seal Name: Registrar Head of Organisation
	Finance Officer Tezpur University	Registrar Tezpur University

(Strike out inapplicable terms)