



Visvesvaraya Technological University

(State University of Government of Karnataka Established as per the VTU Act, 1994)

Jnana Sangama, Belagavi – 590 018, Karnataka, India

Dr. B. E. Rangaswamy Ph.D
Registrar (Evaluation)

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Ref.No/VTU/Exam/QPDS/2022-2023/ 362

Date: 21 JUN 2022

CIRCULAR

Sub: Time Table of Semester End examination, July/August 2022.

The time table of the University examination to be held at the end of the even semesters (July/August 2022) of B.E./ B.Tech./ B.Arch. / B.Plan. / MCA / M.Tech. / M.Arch / MBA courses is published on the VTU Website <https://vtu.ac.in>

The Time table for III/IV Semester B.E. / B.Tech (2018 Scheme), I/II Semester UG (2021 Scheme) and I/II Semester PG (2020 Scheme) will be announced later.

Also, the Time table for eligible students of Ist to VIth Semester B.E. / B.Tech (2010 Scheme) and I/II Semester of B.E. / B.Tech (2014 Scheme) will be announced later.

The Principals of all the affiliated engineering colleges and constituent engineering college are requested to go through the time table and bring the contents of the same to the notice of all the concerned.

Sd/-
Registrar (Evaluation)

To,

The Principals of all the affiliated engineering colleges and constituent engineering college.

C.W.C. :

1. The Hon'ble Vice Chancellor, through the Secretary to VC, VTU, Belagavi, for kind information.
2. The Registrar, VTU, Belagavi, for kind information.
3. The Regional Directors, R.O. Bengaluru /Belagavi /Kalaburagi /Mysuru, for kind information.

Rangaswamy 21/06/2022 BE
Registrar (Evaluation)


Visvesvaraya Technological University, Belagavi

Time Table for Only Eligible Students of B.E./B.Tech. Examinations, July/August 2022

Semester → Time → Date, Day ↓	2010 Scheme		2015 Scheme (CBCS)		2017 Scheme (CBCS)		2018 Scheme(CBCS)	
	VII - Sem	VIII - Sem	VII - Sem	VIII - Sem	VII - Sem	VIII - Sem	VII - Sem	VIII - Sem
	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm
04-07-2022, Mon	10**71		15**71		17**71		18**71	
05-07-2022, Tue		10**81		15**81		17**81		18**81
06-07-2022, Wed	10**72		15**72		17**72		18**72	
07-07-2022, Thu		10**82		15**82		17**82		18**82*
08-07-2022, Fri	10**73		15**73		17**73		18**73*	
09-07-2022, Sat								
		S	U	N	D	A	Y	
11-07-2022, Mon	10**74		15**74/74*		17**74/74*		18**74*	
12-07-2022, Tue		10**83*		15**83*		17**83*		
13-07-2022, Wed	10**75*		15**75*		17**75*		18**75*	
14-07-2022, Thu		10**84*						
15-07-2022, Fri	10**76*		15**76*		17**76*			
16-07-2022, Sat	10EVR77							

Note : As per syllabi, some papers are of four hours duration. The timing for such papers is 1.30 pm to 5.30 pm .

[Subject List : 10CV766, 10CV82]


 Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi

Time Table for Only Eligible Students of B.E./B.Tech. Examinations, July / August 2022

Semester → Time → Date, Day ↓	2015 Scheme (CBCS)					2017 Scheme (CBCS)					2018 Scheme (CBCS)		
	I / II - Sem	III - Sem	IV - Sem	V - Sem	VI - Sem	I / II - Sem	III - Sem	IV - Sem	V - Sem	VI - Sem	I / II - Sem	V - Sem	VI - Sem
	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm
01-08-2022, Mon	15CPH18/28 <small>[9.30am to 11.30am]</small>			15**51		17CIV18/28 <small>[9.30am to 11.30am]</small>			17**51		18EGH18 <small>[2.00pm to 4.00pm]</small>	18CIV59 <small>[9.30am to 11.30am]</small>	
02-08-2022, Tue		15MATDIP31					17KKK/KKM39 <small>[2.00pm to 4.00pm]</small>	17KKK/KKM49 <small>[2.00pm to 4.00pm]</small>					18**61
03-08-2022, Wed	15CIV18/28 <small>[9.30am to 11.30am]</small>		15MATDIP41			17PHY12/22 <small>[2.00pm to 4.00pm]</small>	17CPH39 <small>[2.00pm to 4.00pm]</small>	17CPH49 <small>[2.00pm to 4.00pm]</small>			18MAT21		
04-08-2022, Thu	15EME14/24			15**52		17CHE12/22			17**52		18EGH28 <small>[2.00pm to 4.00pm]</small>	18**51	
05-08-2022, Fri		15**31 <small>(includes 15MAT31)</small>			15**61		17**31 <small>(includes 17MAT31)</small>			17**61			18**62
06-08-2022, Sat	15MAT11		15**41 <small>(includes 15MAT41)</small>			17CIV13/23		17**41 <small>(includes 17MAT41)</small>			18CHE12/22		
S U N D A Y													
08-08-2022, Mon	15ELN15/25			15**53		17ELN15/25			17**53		18PHY12/22	18**52	
09-08-2022, Tue	Last Day of Moharam												
10-08-2022, Wed		15**32			15**62		17**32			17**62			18**63
11-08-2022, Thu	15ELE15/25		15**42			17EME14/24		17**42			18ELN14/24		
12-08-2022, Fri	15PCD13/23			15**54		17PCD13/23			17**54		18ELE13/23	18**53	
13-08-2022, Sat	S U N D A Y												
Independence Day													
15-08-2022, Mon													
16-08-2022, Tue		15**33			15**63		17**33			17**63			18**64*
17-08-2022, Wed	15PHY12/22		15**43					17**43			18ME15/25		
18-08-2022, Thu	15CHE12/22			15**55*		17ELE15/25			17**55*		18CIV14/24	18**54	
19-08-2022, Fri		15**34			15**64		17**34			17**64			18**65*
20-08-2022, Sat	15MAT21		15**44			17MAT11		17**44			18CPS13/23		
S U N D A Y													
22-08-2022, Mon	15CIV13/23			15**56*					17**56*			18**55	
23-08-2022, Tue		15**35			15**65*	17MAT21	17**35			17**65*	18MAT11		
24-08-2022, Wed			15**45					17**45					
25-08-2022, Thu		15**36			15**66*		17**36			17**66*		18**56	
26-08-2022, Fri			15**46					17**46					
27-08-2022, Sat	S U N D A Y												
29-08-2022, Mon							17MATDIP31						
30-08-2022, Tue								17MATDIP41					

Note : 1. As per syllabi, some papers are of four hours duration. The timing for such papers is as follows:

For morning session : 9.30 am to 1.30 pm For evening session : 1.30 pm to 5.30 pm

2. The practical examination for both Regular and Arrear Students to be conducted from 18/07/2022 to 29/07/2022, batchwise.

Reg 21/06/2022 *BE*
Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi
Time Table for Only Eligible Students of B.Arch. Examinations, July/August 2022

Semester → Time → Date, Day ↓	2015 Scheme								2018 Scheme							
	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII
	9.30am to 12.30pm	9.30am to 12.30pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm
01-08-2022, Mon				15ARC42 (9.30pm to 1.30pm)				15ARC82 (1.30pm to 5.30pm)				18ARC42 (9.30am to 1.30 pm)				18ARC82 (1.30PM to 5.30pm)
02-08-2022, Tue	15ARC12 (9.30am to 1.30 pm)						15ARC72 (1.30pm to 5.30pm)		18ARC14						18ARC73	
03-08-2022, Wed		15ARC22 (9.30am to 1.30 pm)			15ARC52 (1.30PM to 5.30pm)					18ARC22 (9.30am to 1.30 pm)			18ARC53			
04-08-2022, Thu			15ARC32 (9.30am to 1.30 pm)			15ARC62 (1.30PM to 5.30pm)					18ARC33			18ARC62 (1.30PM to 5.30pm)		
05-08-2022, Fri				15ENG43				15ARC84				18ARC43				18ARC84
06-08-2022, Sat	15ARC14						15ARC73		18ENG15						18ENG74	
S U N D A Y																
08-08-2022, Mon		15ARC24			15ARC53					18ARC24			18ARC54			
09-08-2022, Tue	Last Day of Moharam															
10-08-2022, Wed			15ARC33			15ARC63					18ARC34			18ARC63		
11-08-2022, Thu				15ARC44				15ARC86				18ARC44			18ARC75	18ENG85
12-08-2022, Fri	15ENG15						15ARC74			18ENG25			18HUM56			
13-08-2022, Sat																
S U N D A Y																
15-08-2022, Mon	Independence Day															
16-08-2022, Tue		15ENG25			15ARC54						18ARC36			18ARC64		
17-08-2022, Wed			15ARC34			15ARC64						18ARC46				18ARC86
18-08-2022, Thu				15ENG46				15ARC87		18ENG27				18ARC66		
19-08-2022, Fri		15ARC26						15ARC76								
20-08-2022, Sat			15ARC36			15ARC66										
S U N D A Y																
22-08-2022, Mon		15ENG27			15HUM56											

Note: 1. The Practical/Viva examinations for eligible candidates of VI-Semester to be conducted from 18/07/2022 to 29/07/2022 batchwise.
2. The Practical/Viva examinations for eligible candidates of IV & VIII Semesters to be conducted from 25/07/2022 to 30/07/2022 batchwise.

Reg 21/06/2022 *BE*
Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi
Time Table for Only Eligible Students of B.Arch. Examinations, July/August 2022

Semester → Time → Date, Day ↓	2009 Scheme								2014 Scheme	
	I	II	III	IV	V	VI	VII	VIII	I	II
	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm
01-08-2022, Mon	09ARC14	--	09ARC/ENG33	--	09ARC53	--	09ARC73	--	--	14ARC22 (1.30pm to 5.30 pm)
02-08-2022, Tue	--	09ARC24	--	09ARC43	--	09ARC63	--	09ARC84	14ARC12 (1.30pm to 5.30 pm)	--
03-08-2022, Wed	09ENG15	--	09ARC34/34A	--	09ARC54	--	09ARC74	--	--	14ARC24
04-08-2022, Thu	--	09ENG25	--	09ARC44	--	09ARC64	--	--	14ARC14	--
05-08-2022, Fri	--	--	09ARC/ENG35	--	09ENG55	--	09ENG75	--	--	14ENG25
06-08-2022, Sat	--	09ENG26	--	09ENG45	--	09ENG65	--	--	14ENG15	--
		S	U	N	D	A	Y			
08-08-2022, Mon	--	--	09ARC37	--	09HUM57	--	09ARC77	--	--	14ARC26
09-08-2022, Tue	Last Day of Moharam									
10-08-2022, Wed	--	09ART27	--	--	--	09ARC66	--	--	--	--
11-08-2022, Thu	--	--	--	--	09ARC58	--	--	--	--	14ENG27
12-08-2022, Fri	--	--	--	--	--	09ARC68	--	--	--	--

Reg 21/06/2022 ^{BE}
 Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi

Time Table for Only Eligible Students of B.Planning Examinations, July/August 2022

Semester → Time → Date, Day ↓	2017 Scheme								2018 Scheme							
	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII
	9.30am to 12.30pm	2.00pm to 5.00pm	9.30am to 12.30pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm
04-07-2022, Mon								17PLN81								18PLN81
05-07-2022, Tue							17PLN71								18PLN71	
06-07-2022, Wed								17PLN82								18PLN82
07-07-2022, Thu							17PLN72								18PLN72	
08-07-2022, Fri								17PLN83*								18PLN83*
11-07-2022, Mon							17PLN73*								18PLN73	
13-07-2022, Wed							17PLN74								18PLN76*	
01-08-2022, Mon			17PLN31								18PLN31			18PLN61		
02-08-2022, Tue		17PLN21				17PLN61			18PLN11			18PLN41				
03-08-2022, Wed					17PLN51					18PLN21			18PLN51			
04-08-2022, Thu	17PLN11			17PLN41							18PLN32			18PLN62		
05-08-2022, Fri			17PLN32						18PLN12			18PLN42				
06-08-2022, Sat		17PLN22				17PLN62				18PLN22			18PLN52			
S U N D A Y																
08-08-2022, Mon					17PLN52						18PLN33			18PLN63		
09-08-2022, Tue	Last Day of Moharam															
10-08-2022, Wed	17PLN12			17PLN42					18PLN13			18PLN43				
11-08-2022, Thu			17PLN33							18PLN23			18PLN53			
12-08-2022, Fri		17PLN23				17PLN63					18PLN34			18PLN64		
13-08-2022, Sat																
S U N D A Y																
15-08-2022, Mon	Independence Day															
16-08-2022, Tue					17PLN53				18PLN15			18PLN44				
17-08-2022, Wed	17PLN13			17PLN43							18PLN35			18PLN65		
18-08-2022, Thu			17PLN34							18PLN24			18PLN54			
19-08-2022, Fri		17PLN24				17PLN64						18PLN45				
20-08-2022, Sat					17PLN54					18PLN26				18PLN66*		
S U N D A Y																
22-08-2022, Mon	17PLN16			17PLN44									18PLN56*			
23-08-2022, Tue			17PLN35													
24-08-2022, Wed		17PLN26				17PLN65*										
25-08-2022, Thu						17PLN55*										
26-08-2022, Fri				17PLN46		17PLN66										

- Note: 1. The Practical/Viva examinations for eligible candidates of VI-Semester to be conducted from 18/07/2022 to 29/07/2022 batchwise.
 2. The Practical/Viva examinations for eligible candidates of IV-Semester to be conducted from 25/07/2022 to 30/07/2022 batchwise.

Ray B E
 21/06/2022
 Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi
Time Table for Only Eligible Students of MCA Examinations, July/August 2022

Semester→ Time → Date, Day↓	2013 Scheme					2016 Scheme[CBCS]					2017 Scheme[CBCS]					2018 Scheme[CBCS]					2020 Scheme[CBCS]	
	I-Sem 2.00pm to 5.00pm	II-Sem 9.30am to 12.30pm	III-Sem 9.30am to 12.30pm	IV-Sem 2.00pm to 5.00pm	V-Sem 2.00pm to 5.00pm	I-Sem 9.30am to 12.30pm	II-Sem 9.30am to 12.30pm	III-Sem 2.00pm to 5.00pm	IV-Sem 2.00pm to 5.00pm	V-Sem 9.30am to 12.30pm	I-Sem 9.30am to 12.30pm	II-Sem 9.30am to 12.30pm	III-Sem 2.00pm to 5.00pm	IV-Sem 2.00pm to 5.00pm	V-Sem 9.30am to 12.30pm	I-Sem 9.30am to 12.30pm	II-Sem 9.30am to 12.30pm	III-Sem 2.00pm to 5.00pm	IV-Sem 2.00pm to 5.00pm	V-Sem 9.30am to 12.30pm	III-Sem 2.00pm to 5.00pm	IV-Sem 2.00pm to 5.00pm
11-07-2022, Mon																	18MCA21		18MCA41		20MCA31	
12-07-2022, Tue		13MCA21		13MCA41		16MCA11		16MCA31		16MCA51	17MCA11		17MCA31		17MCA51	18MCA11		18MCA31		18MCA51		20MCA41
13-07-2022, Wed	13MCA11		13MCA31		13MCA51		16MCA21		16MCA41		17MCA21		17MCA41			18MCA22		18MCA42		20MCA32		
14-07-2022, Thu		13MCA22		13MCA42		16MCA12		16MCA32		16MCA52	17MCA12		17MCA32		17MCA52	18MCA12		18MCA32		18MCA52		20MCA42
15-07-2022, Fri	13MCA12		13MCA32		13MCA52		16MCA22		16MCA42		17MCA22		17MCA42			18MCA23		18MCA43		20MCA33		
16-07-2022, Sat		13MCA23		13MCA43		16MCA13		16MCA33		16MCA53	17MCA13		17MCA33		17MCA53	18MCA13		18MCA33		18MCA53		
S U N D A Y																						
18-07-2022, Mon	13MCA13		13MCA33		13MCA53		16MCA23		16MCA43		17MCA23		17MCA43			18MCA24		18MCA44*		20MCA34*		
19-07-2022, Tue		13MCA24		13MCA44*		16MCA14		16MCA34		16MCA54*	17MCA14		17MCA34		17MCA54*	18MCA14		18MCA34		18MCA54*		
20-07-2022, Wed	13MCA14		13MCA34		13MCA54*		16MCA24		16MCA44*		17MCA24		17MCA44*			18MCA25		18MCA45*		20MCA35*		
21-07-2022, Thu		13MCA25		13MCA45*		16MCA15		16MCA35*		16MCA55*	17MCA15		17MCA35*		17MCA55*	18MCA15		18MCA35*		18MCA55*		
22-07-2022, Fri	13MCA15		13MCA35*		13MCA55*		16MCA25		16MCA45*		17MCA25		17MCA45*					18MCA46				

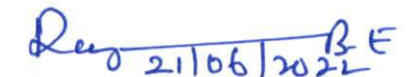
Note: The practical examinations of Eligible students to be conducted from 04/07/2022 to 09/07/2022, batchwise.

Reg 21/06/2022 *BE*
Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi

Time Table for Only Eligible Students of M.TECH. Examinations, July/August 2022

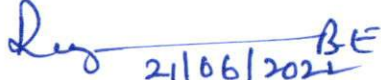
Semester→ Time → Date, Day↓	2014 Scheme			2016 Scheme [CBCS]			2017 Scheme [CBCS]			2018 Scheme (CBCS)			2020 Scheme [CBCS]
	I	II	IV	I	II	IV	I	II	IV	I	II	III	III
	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm
20-07-2022, Wed										18***11			20***31
21-07-2022, Thu	14***11				16***21			17***21			18***21		
22-07-2022, Fri		14***21		16***11		16***41	17***11		17***41	18***12			20***32*
23-07-2022, Sat													
S U N D A Y													
25-07-2022, Mon	14***12				16***22			17***22			18***22		
26-07-2022, Tue		14***22		16***12		16***42*	17***12		17***42*	18***13		18***31	20***33*
27-07-2022, Wed	14***13		14***41		16***23			17***23			18***23		
28-07-2022, Thu		14***23		16***13			17***13			18***14		18***32/32*	
29-07-2022, Fri	14***14		14***42*		16***24			17***24			18***24*		
30-07-2022, Sat		14***24		16***14			17***14			18***15/15*		18***33*	
S U N D A Y													
01-08-2022, Mon	14***15*				16***25*			17***25*			18***25*		
02-08-2022, Tue		14***25*		16***15*			17***15*			18RMI17			


 Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi

Time Table for Only Eligible Students of M.Arch. Examinations, July/August 2022

Semester → Time → Date, Day ↓	Urban Design				Habitat Design				Construction Planning & Mgmt				Digital Architecture			
	2018 Scheme			2020 Scheme	2018 Scheme			2020 Scheme	2018 Scheme			2020 Scheme	2018 Scheme			2020 Scheme
	I	II	III	III	I	II	III	III	I	II	III	III	I	II	III	III
	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm
20-07-2022, Wed	18UDC11		18UDC32	20UDC33	18HDC11		18HDC31	20HDC32	18CPM11		18CPM31	20ACM31	18DAC13		18DAC33	20DAC33
21-07-2022, Thu		18UDC21				18HDC21				18CPM21				18DAS22		
22-07-2022, Fri	18UDS13		18UDS33	20UDS34	18HDC12		18HDC32	20HDC33	18CPM12		18CPM32	20ACM32	18DAS17			
25-07-2022, Mon		18UDS22				18HDC22				18CPM22						
26-07-2022, Tue	18UDS14		18UDS34	20UDS35	18HDC13				18CPM13		18CPM33	20ACM33				
27-07-2022, Wed		18UDS24								18CPM23						


 21/06/2022
 Registrar (Evaluation)

Visvesvaraya Technological University, Belagavi

Time Table for Only Eligible Students of MBA Examinations, July/August 2022

Semester → Time → Date, Day ↓	2016 Scheme (CBCS)				2017 Scheme (CBCS)				2018 Scheme (CBCS)				2020 Scheme (CBCS)	
	I	II	III	IV	I	II	III	IV	I	II	III	IV	III	IV
	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm	9.30am to 12.30pm	9.30am to 12.30pm	2.00pm to 5.00pm	2.00pm to 5.00pm
22-08-2022, Mon		16MBA21		16MBAMM401 16MBAHR404		17MBA21		17MBAMM401 17MBAHR404				18MBAMM401 18MBAHR404		20MBAMM401 20MBAHR404
23-08-2022, Tue	16MBA11		16MBAMM301 16MBAHR304		17MBA11		17MBAMM301 17MBAHR304		18MBA11		18MBAMM301 18MBAHR304		20MBA301	
24-08-2022, Wed		16MBA22		16MBAFM401 16MBAMM404		17MBA22		17MBAFM401 17MBAMM404		18MBA21		18MBAFM401 18MBAMM404		20MBAFM401 20MBAMM404
25-08-2022, Thu	16MBA12		16MBAFM301 16MBAMM304		17MBA12		17MBAFM301 17MBAMM304		18MBA12		18MBAFM301 18MBAMM304		20MBA302	
26-08-2022, Fri		16MBA23		16MBAHR401 16MBAFM404		17MBA23		17MBAHR401 17MBAFM404		18MBA22		18MBAHR401 18MBAFM404		20MBAHR401 20MBAFM404
27-08-2022, Sat														
S U N D A Y														
29-08-2022, Mon	16MBA13		16MBAHR301 16MBAFM304		17MBA13		17MBAHR301 17MBAFM304		18MBA13		18MBAHR301 18MBAFM304		20MBAMM303 20MBAHR305	
30-08-2022, Tue		16MBA24		16MBAMM402 16MBAHR405		17MBA24		17MBAMM402 17MBAHR405		18MBA23		18MBAMM402 18MBAHR405		20MBAMM402 20MBAHR405
Varasiddhi Vinayaka Vrata														
01-09-2022, Thu	16MBA14		16MBAMM302 16MBAHR305		17MBA14		17MBAMM302 17MBAHR305		18MBA14		18MBAMM302 18MBAHR305		20MBAFM303 20MBAMM305	
02-09-2022, Fri		16MBA25		16MBAFM402 16MBAMM405		17MBA25		17MBAFM402 17MBAMM405		18MBA24		18MBAFM402 18MBAMM405		20MBAFM402 20MBAMM405
03-09-2022, Sat	16MBA15		16MBAFM302 16MBAMM305		17MBA15		17MBAFM302 17MBAMM305		18MBA15		18MBAFM302 18MBAMM305		20MBAHR303 20MBAFM305	
S U N D A Y														
05-09-2022, Mon		16MBA26		16MBAHR402 16MBAFM405		17MBA26		17MBAHR402 17MBAFM405		18MBA25		18MBAHR402 18MBAFM405		20MBAHR402 20MBAFM405
06-09-2022, Tue	16MBA16		16MBAHR302 16MBAFM305		17MBA16		17MBAHR302 17MBAFM305		18MBA16		18MBAHR302 18MBAFM305		20MBAMM304 20MBAHR306	
07-09-2022, Wed			16MBAMM403 16MBAHR406				17MBAMM403 17MBAHR406		18MBA26		18MBAMM403 18MBAHR406		20MBAMM403 20MBAHR406	
08-09-2022, Thu			16MBAMM303 16MBAHR306				17MBAMM303 17MBAHR306				18MBAMM303 18MBAHR306		20MBAFM304 20MBAMM306	
09-09-2022, Fri			16MBAFM403 16MBAMM406				17MBAFM403 17MBAMM406				18MBAFM403 18MBAMM406		20MBAFM403 20MBAMM406	
10-09-2022, Sat														
S U N D A Y														
12-09-2022, Mon			16MBAFM303 16MBAMM306				17MBAFM303 17MBAMM306				18MBAFM303 18MBAMM306		20MBAHR304 20MBAFM306	
13-09-2022, Tue			16MBAHR403 16MBAFM406				17MBAHR403 17MBAFM406				18MBAHR403 18MBAFM406		20MBAHR403 20MBAFM406	
14-09-2022, Wed			16MBAHR303 16MBAFM306				17MBAHR303 17MBAFM306				18MBAHR303 18MBAFM306			

Registrar (Evaluation)

Modified

Re: Madam, regarding scheme modifications

B MATS 201

"Dr. Nalinakshi N" <bsehod@atria.edu>

September 30, 2023 7:35 PM

To: boe@vtu.ac.in

Dear sir/ma'am

Please find the attachment of modifications in the scheme and solution of 2022 scheme Second semester Mathematics of all streams.

On Wed, Sep 27, 2023 at 9:47 AM <boe@vtu.ac.in> wrote:

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Best Regards,

Dr. Nalinakshi N

M.Sc., M.Phil., Ph.D
Vice Principal

HoD Basic Sciences & Humanities

BoE-Chairman Maths (Composite)
Board_VTU-Belagavi

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VISION:

To Mold Engineers into better professionals through effective Mathematical thinking, multifaceted application of Applied Sciences to solve societal Issues, fostering liberal arts in realistic situations and to inculcate interdisciplinary research.

MISSION:

Department of Basic Science Engineering & Humanities is committed to:

M1: Enriching Mathematical logic through a multi-disciplinary approach among students.

M2: Augmenting the use of cutting edge technology and theoretical scientific concepts in the area of Applied Sciences.

M3 - Developing effective and ethical communication based on awareness of diverse perspectives, contexts and Social identities.

M4 - Creating a culture that promotes critical consciousness and empathy at various personal, professional and civic contexts.

M5 - Nurturing the ability to perform interdisciplinary research.

Corrections:-

Sub name:- Mathematics for CSE Stream-II

Sub code:- BMATS 201

Q.No. ③ ④ If the student has proved the given curves are not orthogonal then allocate full marks

Q.No. ⑤ ⑥ Any other alternate method can be applied.

⑥ To find basis any other alternate method can be applied.

Q.No. ⑦ ⑧ In equation $= 0$ is missing


$$\Rightarrow x \log_{10} x - 1.2 = 0 \text{ to be taken and solved.}$$

(Standard question)

If taken any other value, since attempt marks can be allotted.

Nalini
Dr. Nalinakshi.N
BoE - Chairman.

"APPROVED"

 Registrar (Evaluation)
Jyoti Basu Technological University
BELAGAVI - 590018

CBCS SCHEME

USN

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BMATS201

Second Semester B.E./B.Tech. Degree Examination, June/July 2023 Mathematics – II for CSE Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M: Marks, L: Bloom's level, C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz \, dz \, dy \, dx$.	7	L2	CO1
	b.	Evaluate by changing the order of integration $\int_0^a \int_y^a \frac{x}{x^2 + y^2} \, dx \, dy$.	7	L3	CO1
	c.	Show that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.	6	L2	CO1
OR					
Q.2	a.	Evaluate $\int_{-2}^2 \int_0^{\sqrt{4-x^2}} (2-x) \, dy \, dx$ by changing into polar coordinates.	7	L3	CO1
	b.	A pyramid is bounded by three coordinate planes and the plane $x + 2y + 3z = 6$. Compute the volume by double integration.	7	L3	CO1
	c.	Using Mathematical tools, write the code to find the area of the cardioids $r = a(1 + \cos\theta)$ by double integration.	6	L3	CO5
Module – 2					
Q.3	a.	Show that the two surfaces $xz + y + z^2 = 9$ and $z = 4 - 4xy$ at $(1, -1, 2)$ are orthogonal.	7	L3	CO2
	b.	If $F = \text{grad}(xy^3z^2)$, find $\text{div}F$ and $\text{curl}F$ at the point $(1, -1, 1)$.	7	L2	CO2
	c.	Prove that the cylindrical coordinate system is orthogonal.	6	L3	CO2
OR					
Q.4	a.	Find the directional derivative of $\phi = x^2 + yz - y^2 + 4$ at $(-1, 2, 1)$ in the direction of the vector $2i - j + 2k$.	7	L2	CO2
	b.	Find the constants a, b and c such that $F = (axy - z^3)i + (bx^2 + cz^2)j + (bxz^2 + cy)k$ is irrotational.	7	L2	CO2
	c.	Using the Mathematical tools, write the codes to find the gradient of $\phi = xy^2z^3$.	6	L3	CO5

Module - 3

Q.5	a.	Let $W = \{(x, y, z) \mid lx + my + nz = 0\}$, then prove that W is a subspace of R^3 .	7	L2	CO3
	b.	Find the basis and the dimension of the subspace spanned by the vectors $\{(2, 4, 2), (1, -1, 0), (1, 2, 1), (0, 3, 1)\}$ in $V_3(R)$.	7	L2	CO3
	c.	Prove that $T : R^3 \rightarrow R^3$ be defined by $T(x, y, z) = (2x-3y, x+4, 5z)$ is not a linear transformation.	6	L3	CO3

OR

Q.6	a.	Show that the matrix $E = \begin{bmatrix} -1 & 7 \\ 8 & -1 \end{bmatrix}$ lies in the sub space span $\{A, B, C\}$ of vector space M_{22} of 2×2 matrices, where $A = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -3 \\ 0 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix}$.	7	L2	CO3
	b.	Verify the Rank-nullity theorem for the linear transformation $T : R^3 \rightarrow R^3$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$.	7	L3	CO3
	c.	Define an Inner product space. Consider $f(t) = 4t + 3$, $g(t) = t^2$, the inner product $\langle f, t \rangle = \int_0^1 f(t)g(t)dt$. Find $\langle f, g \rangle$ and $\ g\ $.	6	L2	CO3

Module - 4

Q.7	a.	Find the real root of the equation $x \log_{10} x - 1.2$ by the Regula-Falsi method between 2 and 3. (Carryout three iterations).	7	L2	CO4												
	b.	From the following table, estimate the number of students who have obtained the marks between 40 and 45	7	L2	CO4												
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>Marks</td> <td>30 - 40</td> <td>40 - 50</td> <td>50 - 60</td> <td>60 - 70</td> <td>70 - 80</td> </tr> <tr> <td>Number of students</td> <td>31</td> <td>42</td> <td>51</td> <td>35</td> <td>31</td> </tr> </table>						Marks	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	Number of students	31	42	51	35	31
Marks	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80												
Number of students	31	42	51	35	31												
	c.	Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$ using Simpson's $\frac{3}{8}$ rule taking six parts.	6	L3	CO4												

OR

Q.8	a.	Using Newton-Raphson method compute the real root of the equation $x \sin x + \cos x = 0$ near $x = \pi$, correct to four decimal places.	7	L2	CO4
	b.	If $y(0) = -12$, $y(1) = 0$, $y(3) = 6$ and $y(4) = 12$, find the Lagrange's interpolation polynomial and estimate $y(2)$.	7	L2	CO4
	c.	Evaluate $\int_0^3 \frac{dx}{4x+5}$ using Trapezoidal rule by taking 7 ordinates.	6	L3	CO4

Module - 5

Q.9	a.	Employ Taylor's series method to obtain $y(0.1)$ for $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$ considering upto 4 th degree terms.	7	L2	CO4
	b.	Using Runge-Kutta method of fourth order solve $y' = \log_{10} \left[\frac{y}{1-x} \right]$ given $y(0) = 1$ at $x = 0.2$	7	L3	CO4

	c.	Solve $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$, $y(0.3) = 2.090$. find $y(0.4)$ using Milne's method.	6	L2	CO4										
OR															
Q.10	a.	Given $\frac{dy}{dx} = x + \sqrt{y}$, $y(0) = 1$. Compute $y(0.4)$ with $h = 0.2$ using Euler's modified method. Perform two modifications in each stage.	7	L2	CO4										
	b.	Apply Milne's predictor-corrector formulae to compute $y(4.5)$, given that $5x \frac{dy}{dx} = 2 - y^2$ and	7	L2	CO4										
		<table border="1" style="margin-left: 20px;"> <tr> <td>x</td> <td>4.1</td> <td>4.2</td> <td>4.3</td> <td>4.4</td> </tr> <tr> <td>y</td> <td>1.0049</td> <td>1.0097</td> <td>1.0143</td> <td>1.0187</td> </tr> </table>	x	4.1	4.2	4.3	4.4	y	1.0049	1.0097	1.0143	1.0187			
x	4.1	4.2	4.3	4.4											
y	1.0049	1.0097	1.0143	1.0187											
	c.	Using modern mathematical tools, write the code to find the solution of $\frac{dy}{dx} = x - y^2$ at $y(0.2)$. Given that $y(0) = 1$ by Runge-Kutta 4 th order method. (Take $h = 0.2$)	6	L3	CO5										



Visvesvaraya Technological University
Belagavi, Karnataka - 590 018.

Signature of *[Handwritten Name]* 08/09/20

Scheme & Solutions

Subject Title : Mathematics - II for Computer Science Engineering Subject Code : BMATS 201

Question Number	Solution	Marks Allocated
Q.01 a	$\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz \, dz \, dy \, dx = \int_0^1 \int_0^{\sqrt{1-x^2}} \left[\frac{xyz^2}{2} - \frac{x^3y}{2} - \frac{xy^3}{2} \right] dy \, dx$ $= \int_0^1 \left[\frac{x}{8} - \frac{x^3}{4} + \frac{x^5}{8} \right] dx$ $= \frac{1}{48}$	03M 02M 02M <u>07M</u>
1(b)	$\int_0^a \int_0^a \frac{x}{y(x^2+y^2)} \, dx \, dy = \int_0^a \int_0^x \frac{x}{x^2+y^2} \, dy \, dx$ $= \int_0^a \tan^{-1}\left(\frac{y}{x}\right) \Big _0^x \, dx = \int_0^a \frac{\pi}{4} \, dy = \frac{\pi a}{4}$	Fig 01M 03M 03M <u>07M</u>
1(c)	$\Gamma(m)\Gamma(n) = \left(2 \int_0^b e^{-x^2} x^{2m-1} \, dx\right) \left(2 \int_0^b e^{-y^2} y^{2n-1} \, dy\right)$ $= 4 \int_0^b \int_0^b e^{-(x^2+y^2)} x^{2m-1} y^{2n-1} \, dx \, dy$ $= 4 \int_0^{\pi/2} \int_0^b e^{-r^2} r^{2(m+n)-1} \cos \theta \sin \theta \, dr \, d\theta$ $= \left(2 \int_0^{\pi/2} \cos^{2m-1} \theta \sin^{2n-1} \theta \, d\theta\right) \left(2 \int_0^b e^{-r^2} r^{2(m+n)-1} \, dr\right)$ $\Gamma(m)\Gamma(n) = \beta(m,n) \Gamma(m+n) \Rightarrow \beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$	02M 01M 07M 02M <u>06M</u>
Q.02 a	$\int_{-2}^2 \int_0^{\sqrt{4-x^2}} (2-x) \, dy \, dx = \int_0^\pi \int_0^2 (2-r \cos \theta) r \, dr \, d\theta$ <p>(taking $x=r \cos \theta, y=r \sin \theta, dx \, dy = r \, dr \, d\theta$)</p> $= \int_0^\pi \left(4 - \frac{8}{3} \cos \theta\right) d\theta = 4\pi$	Fig 01M 03M 03M <u>07M</u>
2b	$\text{Volume} = \iint z \, dx \, dy = \int_0^6 \int_0^{\frac{1}{2}(6-x)} \frac{1}{3}(6-x-2y) \, dy \, dx$ $= \frac{1}{12} \int_0^6 (6-x)^2 \, dx = 6 \text{ cubic units}$	03M 04M <u>07M</u>

Question Number	Solution	Marks Allocated
2c)	<p>Python code:</p> <pre> from sympy import * r = Symbol('r') t = Symbol('t') a = Symbol('a') A = 2 * integrate(r, (r, 0, a*(1+cos(t)))) , (t, 0, pi) display(A) </pre>	06M
Q.03a	<p>Two surfaces f & g are orthogonal $\Rightarrow \nabla f \cdot \nabla g = 0$ $\nabla f = i \frac{\partial f}{\partial x} + j \frac{\partial f}{\partial y} + k \frac{\partial f}{\partial z} = zi + j + 2zk$; $\nabla g = 4yi + 4xj + k$ at $(1, -1, 2)$ $\nabla f = 2i + j + 4k$; $\nabla g = -4i + 4j + k$ Now $\nabla f \cdot \nabla g = -8 + 4 + 4 = 0 \therefore$ orthogonal</p>	01M 03M 02M 01M <hr/> 07M
3b)	<p>$F = \nabla(xy^3z^2) = i \frac{\partial \phi}{\partial x} + j \frac{\partial \phi}{\partial y} + k \frac{\partial \phi}{\partial z} = (y^3z^2)i + (3xy^2z^2)j + (2xy^3z)k$ $\text{div } F = \nabla \cdot F = \frac{\partial f_1}{\partial x} + \frac{\partial f_2}{\partial y} + \frac{\partial f_3}{\partial z} = 6xyz^2 + 2xy^3$ at $(1, -1, 1)$ $\text{div } F = \nabla \cdot F = -8$ $\text{curl } F = \nabla \times F = \begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ y^3z^2 & 3xy^2z^2 & 2xy^3z \end{vmatrix} = 0$</p>	02M 02M 01M 02M <hr/> 07M
3c)	<p>at any point P, $x = r \cos \phi$, $y = r \sin \phi$, $z = z \therefore R = r \cos \phi i + r \sin \phi j + z k$ Tangent Vectors: $\frac{\partial R}{\partial \phi} = -r \sin \phi i + r \cos \phi j$, $\frac{\partial R}{\partial r} = \cos \phi i + \sin \phi j$, $\frac{\partial R}{\partial z} = k$ Unit T.Vectors: $\hat{T}_\phi = \frac{-\sin \phi i + \cos \phi j}{1}$, $\hat{T}_r = \frac{\cos \phi i + \sin \phi j}{1}$, $\hat{T}_z = \frac{k}{1}$ where $\hat{T}_r = \frac{\partial R / \partial r}{h_1}$, $\hat{T}_\phi = \frac{\partial R / \partial \phi}{h_2}$, $\hat{T}_z = \frac{\partial R / \partial z}{h_3}$ & $h_1 = 1, h_2 = r, h_3 = 1$ - scale factors $\therefore \hat{T}_r \cdot \hat{T}_\phi = -\cos \phi \sin \phi + \sin \phi \cos \phi = 0$; $\hat{T}_\phi \cdot \hat{T}_z = 0$; $\hat{T}_z \cdot \hat{T}_r = 0$ Hence cylindrical Co-ordinate system is orthogonal.</p>	01M 02M 01M 1M <hr/> 02M 06M
4a)	<p>$\phi = x \log z - y^2 + 4$, $\nabla \phi = \log z i - 2y j + \frac{x}{z} k$ at $(-1, 2, 1)$; $\nabla \phi = -4j - k$ $\vec{a} = 2i - j - 2k$ (given) $D \cdot \text{Dir } \phi$ along $\vec{a} = \nabla \phi \cdot \frac{\vec{a}}{ \vec{a} } = \frac{6}{\sqrt{9}} = 2$</p>	03M 01M 03M <hr/> 07M
4b)	<p>Since F is irrotational - $\nabla \times F = \vec{0}$ $\nabla \times F = \begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ axy - z^3 & bx^2 + z & bxz^2 + cy \end{vmatrix}$ $= (c-1)i - (bz^2 + 3z^2)j + (2bx - ax)k = \vec{0}$ $\Rightarrow a = -6, b = -3, c = 1$</p>	02M 02M 03M <hr/> 07M

Question Number	Solution	Marks Allocated
4c	<p>Python code :</p> <pre> from sympy.vector import * from sympy import symbols N = CoordSys3D('N') x,y,z = symbols('x y z') A = N.x * N.y * x * 2 * N.z * 3 gradA = gradient(A) Print(f'\n Gradient of {A} is (m)') display(gradA) </pre>	06M
Q.05a	<p>$W = \{(x,y,z) \mid 2x+my+nz=0\}$ Let $u, v \in W$ $u = (x_1, y_1, z_1) \therefore 2x_1+my_1+nz_1=0$ $v = (x_2, y_2, z_2) \therefore 2x_2+my_2+nz_2=0$</p> <p>For any $c \in \mathbb{R}$, $cu+v = (cx_1+x_2, cy_1+y_2, cz_1+z_2) \in W$ b'coz $2(cx_1+x_2)+m(cy_1+y_2)+n(cz_1+z_2)$ $= c(2x_1+my_1+nz_1) + (2x_2+my_2+nz_2) = 0$</p> <p>By thm on Subspace (statement), W is a subspace of \mathbb{R}^3. (A nonempty subset W of a vector space V over \mathbb{R} is a subspace iff for any $u, v \in W, c \in \mathbb{R}, (cu+ve) \in W$.)</p>	02M 03M 02M
5b	<p>$A = \begin{bmatrix} 2 & 1 & 1 & 0 \\ 4 & -1 & 2 & 3 \\ 2 & 0 & 1 & 0 \end{bmatrix} \xrightarrow[R_3 \rightarrow R_3 - R_1]{R_2 \rightarrow R_2 - 2R_1} \begin{bmatrix} 2 & 1 & 1 & 0 \\ 0 & -3 & 0 & 3 \\ 0 & -1 & 0 & 1 \end{bmatrix} \xrightarrow{R_3 \rightarrow 3R_3 - R_2} \begin{bmatrix} 2 & 1 & 1 & 0 \\ 0 & -3 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$</p> <p>Since the 1st & 2nd columns of A are pivot columns, and are linearly independent vectors. Basis of $W = \{(2, 4, 2), (1, -1, 0)\} \therefore \dim(W) = 2$</p>	04M 02+01M 07M
5c	<p>Let $u = (x_1, y_1, z_1)$ $v = (x_2, y_2, z_2)$ $T(u+v) = T(x_1+x_2, y_1+y_2, z_1+z_2) = (2(x_1+x_2)-3(y_1+y_2), x_1+x_2+4, 5(z_1+z_2))$ $= (2x_1+2x_2-3y_1-3y_2, x_1+x_2+4, 5z_1+5z_2)$</p> <p>$T(u) + T(v) = T(x_1, y_1, z_1) + T(x_2, y_2, z_2)$ $= (2x_1-3y_1, x_1+4, 5z_1) + (2x_2-3y_2, x_2+4, 5z_2)$ $= (2x_1+2x_2-3y_1-3y_2, x_1+x_2+8, 5z_1+5z_2)$ $\Rightarrow T(u+v) \neq T(u) + T(v) \therefore T$ is not a linear.</p>	02M 02M 02M 06M
Q.06a	<p>Suppose $E \in \text{Span}(A, B, C)$ then $c_1A + c_2B + c_3C = E$ $\Rightarrow c_1 \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} + c_2 \begin{bmatrix} 2 & -3 \\ 0 & 2 \end{bmatrix} + c_3 \begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} -1 & 7 \\ 8 & -1 \end{bmatrix} \Rightarrow \begin{cases} c_1 + 2c_2 = -1 \\ -3c_2 + c_3 = 7 \\ 2c_1 + 2c_3 = 8 \\ c_1 + 2c_2 = -1 \end{cases}$</p> <p>Solving the 1st 3 eqns, $c_1 = 3, c_2 = -2, c_3 = 1$ and this satisfies fourth eqn. $\therefore c_1A + c_2B + c_3C = E \Rightarrow E \in \text{Span}(A, B, C)$</p>	02M 03M 02M 07M
6b	<p>dimension of $\ker(T)$: $T(x, y, z) = (x+2y-2z, y+z, x+4-2z)$ $= (0, 0, 0)$</p>	

Question Number	Solution	Marks Allocated																																				
	<p>which gives $y = -z, x = z - 2y = 3z$ if $(x, y, z) \equiv (3z, -z, z)$ $\equiv z(3, -1, 1)$ $\therefore \text{Ker } T = \text{Span}\{(3, -1, 1)\}$ $(3, -1, 1)$ is a basis of $\text{Ker}(T) \therefore \text{nullity} = \dim(\text{Ker } T) = 1$ dimension of the image of $T: T(x, y, z) = \begin{pmatrix} 1 & 2 & -1 \\ 0 & 1 & -2 \\ 1 & 1 & -2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$ $\therefore A = \begin{bmatrix} 1 & 2 & -1 \\ 0 & 1 & -2 \\ 1 & 1 & -2 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 2 & -1 \\ 0 & 1 & -2 \\ 0 & 0 & 0 \end{bmatrix}$ its Echelon form So $\{(1, 0, 1), (2, 1, 1)\}$ form a basis of $\text{Image}(T)$ $\text{Rank}(T) = \dim(\text{Image } T) = 2 \quad \dim \mathbb{R}^3 = 3$ $\therefore \text{nullity} + \text{Rank} = \dim \therefore \text{Thm verified}$</p>	<p>-03m -03m 01m 07m</p>																																				
6c	<p>Defn of inner product space $\langle f, t \rangle = \int_0^1 (4t^3 + 3t^2) dt = 2$ $\ g\ = \sqrt{\langle g, g \rangle}; \langle g, g \rangle = \int_0^1 t^4 dt = \frac{1}{5} \therefore \ g\ = \frac{1}{\sqrt{5}}$</p>	<p>02 02 02 06m</p>																																				
Q.07 a	<p>$f(2) = -0.5979, f(3) = 0.2314 \quad x = \frac{af(b) - bf(a)}{f(b) - f(a)}$ $x_1 = 2.7210, f(x_1) = -0.0171; x_2 = 2.7402, f(x_2) = -0.0004$ $x_3 = 2.7406, f(x_3) = 0 \therefore x = 2.7406$</p>	<p>02+02m 02+01m 07m</p>																																				
7b	<p>$y =$ no of students with $\leq x$ marks</p> <table border="1" style="display: inline-table; vertical-align: middle;"> <thead> <tr> <th>x</th> <th>y</th> <th>Δy</th> <th>$\Delta^2 y$</th> <th>$\Delta^3 y$</th> <th>$\Delta^4 y$</th> </tr> </thead> <tbody> <tr> <td>40</td> <td>31</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>50</td> <td>73</td> <td>42</td> <td></td> <td></td> <td></td> </tr> <tr> <td>60</td> <td>124</td> <td>51</td> <td>9</td> <td></td> <td></td> </tr> <tr> <td>70</td> <td>159</td> <td>35</td> <td>-16</td> <td>-25</td> <td></td> </tr> <tr> <td>80</td> <td>190</td> <td>31</td> <td>-4</td> <td>12</td> <td>37</td> </tr> </tbody> </table> <p>$p = \frac{x - x_0}{h} = 0.5$ $y(x) = y_0 + p \Delta y_0 + \frac{p(p-1)}{2!} \Delta^2 y_0 + \frac{p(p-1)(p-2)}{3!} \Delta^3 y_0 + \frac{p(p-1)(p-2)(p-3)}{4!} \Delta^4 y_0$ $y(45) = 47 + \frac{5}{10} \cdot 42 + \frac{5(5-1)}{2 \cdot 100} \cdot 9 + \frac{5(5-1)(5-2)}{6 \cdot 1000} \cdot (-25) + \frac{5(5-1)(5-2)(5-3)}{24 \cdot 10000} \cdot 37$ \therefore no of students between 40 & 45 = $y(45) - y(40) = 17$ students.</p>	x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$	40	31					50	73	42				60	124	51	9			70	159	35	-16	-25		80	190	31	-4	12	37	<p>Table 43m 02m 01m 07m</p>
x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$																																	
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7c	<table border="1" style="display: inline-table; vertical-align: middle;"> <thead> <tr> <th>x</th> <th>0.2</th> <th>0.4</th> <th>0.6</th> <th>0.8</th> <th>1.0</th> <th>1.2</th> <th>1.4</th> </tr> </thead> <tbody> <tr> <td>y</td> <td>3.0295</td> <td>2.7975</td> <td>2.8976</td> <td>3.1660</td> <td>3.5598</td> <td>4.0698</td> <td>4.7042</td> </tr> </tbody> </table> <p>$\therefore \int_{0.2}^{1.4} (\sin x - \log x + e^x) dx = \frac{3h}{2} (y_0 + y_6 + 2y_3 + 3(y_1 + y_2 + y_4 + y_5))$ $= 4.0530$</p>	x	0.2	0.4	0.6	0.8	1.0	1.2	1.4	y	3.0295	2.7975	2.8976	3.1660	3.5598	4.0698	4.7042	<p>01+03m 02m 06m</p>																				
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y	3.0295	2.7975	2.8976	3.1660	3.5598	4.0698	4.7042																															
Q.08 a	<p>$f(x) = x \sin x + \cos x; f'(x) = x \cos x \quad x_0 = \pi$ $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}; x_1 = 2.8233; x_2 = 2.7986; x_3 = 2.7984; x_4 = 2.7984$ \therefore root $x = 2.7984$ correct to 4 decimal places.</p>	<p>01m 02+03m 01m 07m</p>																																				
8b	<p>$y = f(x) = \frac{(x-x_0)(x-x_2)(x-x_3)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)} y_0 + \frac{(x-x_0)(x-x_2)(x-x_3)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)} y_1 + \frac{(x-x_0)(x-x_1)(x-x_3)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)} y_2 + \frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)} y_3$ $= \frac{(x-1)(x-3)(x-4)(-12)}{-1x-3x-4} + \frac{2(x-1)(x-4)(x(x-1)(x-3)/2)}{3x^2x-1} + \frac{x(x-1)(x-3)/2}{4x^3x1}$ $= x^3 - 7x^2 + 18x - 12$ $\therefore y(2) = 4$</p>	<p>03m 03m 01m 07m</p>																																				

Question Number	Solution	Marks Allocated																
8c	<p>T ordinates \Rightarrow n=6 parts $h = \frac{3-0}{6} = 0.5$</p> <table border="1"> <tr> <td>x</td> <td>0</td> <td>0.5</td> <td>1</td> <td>1.5</td> <td>2.0</td> <td>2.5</td> <td>3.0</td> </tr> <tr> <td>y</td> <td>1/5 0.2</td> <td>1/7 0.1428</td> <td>1/9 0.1111</td> <td>1/11 0.0909</td> <td>1/13 0.0769</td> <td>1/15 0.0666</td> <td>1/17 0.0588</td> </tr> </table> <p>$\int_0^3 \frac{1}{4x+5} dx = \frac{1}{2} [4y_0 + y_6 + 2(y_1 + y_2 + y_3 + y_4 + y_5)] = 0.3089$</p>	x	0	0.5	1	1.5	2.0	2.5	3.0	y	1/5 0.2	1/7 0.1428	1/9 0.1111	1/11 0.0909	1/13 0.0769	1/15 0.0666	1/17 0.0588	<p>01m</p> <p>03m</p> <p>02m</p> <p>06m</p>
x	0	0.5	1	1.5	2.0	2.5	3.0											
y	1/5 0.2	1/7 0.1428	1/9 0.1111	1/11 0.0909	1/13 0.0769	1/15 0.0666	1/17 0.0588											
Q.09 a	<p>$y' = 2y + 3e^x$; $y'' = 2y' + 3e^x$; $y''' = 2y'' + 3e^x$; $y^{(4)} = 2y''' + 3e^x$</p> <p>$y'(0) = 3$, $y''(0) = 9$, $y'''(0) = 21$, $y^{(4)}(0) = 45$</p> <p>$y(x) = 3x + \frac{9}{2}x^2 + \frac{7}{2}x^3 + \frac{15x^4}{8}$; $y(0.1) = 0.3487$</p>	<p>04m</p> <p>02+01m</p> <p>07m</p>																
9b	<p>$x_0 = 0, y_0 = 1, h = 0.2$ $k_1 = h f(x_0, y_0) = 0$; $k_2 = h f(x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}) = 0.0092$</p> <p>$k_3 = h f(x_0 + \frac{h}{2}, y_0 + \frac{k_2}{2}) = 0.0096$; $k_4 = h f(x_0 + h, y_0 + k_3) = 0.0202$</p> <p>$y(0.2) = y_1 = y_0 + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4) = 1.0096$</p>	<p>04m</p> <p>03m</p> <p>07m</p>																
9c	<p>$y' = 2e^x - y, x_0 = 0, h = 0.1$; $y'_1 = 0.2003$; $y'_2 = 0.4028$; $y'_3 = 0.6097$</p> <p>$y_4^{(p)} = y_0 + \frac{h}{3}[2y'_1 - y'_2 + 2y'_3] = 2.1623$; $y_4 = 0.8214$</p> <p>$y_4^{(c)} = y_2 + \frac{h}{3}[4y'_2 + 4y'_3 + y'_4] = 2.2121$ $\therefore y(0.4) = 2.2121$</p>	<p>03m</p> <p>02m</p> <p>01m</p> <p>06m</p>																
Q.10 a	<p>$f(x, y) = x + \sqrt{y}$, $x_0 = 0, y_0 = 1, h = 0.2$ $x_1 = 0.2$ $y(0.2) = y_1$</p> <p>$y_1^{(p)} = y_0 + h f(x_0, y_0) = 1.2$; $y_1^{(m1)} = y_0 + \frac{h}{2}[f(x_0, y_0) + f(x_0, y_1^{(p)})] = 1.2295$</p> <p>$y_1^{(m2)} = 1.2309$ $\therefore y(0.2) = 1.2309$</p> <p>$y_2^{(p)} = 1.4928$; $y_2^{(m1)} = 1.5240$; $y_2^{(m2)} = 1.5253$ $\therefore y(0.4) = 1.5253$</p>	<p>01+02+01m</p> <p>03m</p> <p>07m</p>																
10b	<p>$y' = \frac{2-y^2}{5x}, h = 0.1$; $y_1 = 0.0467$, $y_2 = 0.0452$, $y_3 = 0.0437$</p> <p>$y_4^{(p)} = 1.0230$, $y_4 = 0.0424$</p> <p>$y_4^{(c)} = 1.0230$ $\therefore y(4.5) = 1.0230$</p>	<p>03m</p> <p>02m</p> <p>02m</p> <p>07m</p>																
10c	<p>Python code:</p> <pre> from sympy import * def RungeKutta(g, x0, h, y0, xn): x, y = symbols('x y') f = lambdify([x, y], g) xt = x0 + h y = [y0] while xt <= xn: k1 = h * f(x0, y0) k2 = h * f(x0 + h/2, y0 + k1/2) k3 = h * f(x0 + h/2, y0 + k2/2) k4 = h * f(x0 + h, y0 + k3) y1 = y0 + (1/6) * (k1 + 2*k2 + 2*k3 + k4) y.append(y1) print('y(-1.3-3f' + str(xt) + ') is -1.3-3f' + str(y1)) x0 = xt y0 = y1 xt = xt + h return y Y = RungeKutta('x - y**2', 0, 0.2, 1, 0.2) </pre>	<p>06m</p>																

"APPROVED"

Registra. (Evaluation)
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